Better Crops with PLANT FOOD

June - July 1944 10 Cents

The Pocket Book of Agriculture

For Boron Deficiencies

THREE ELEPHANT BORAX

WITH every growing season, more and more evidence of *boron* deficiency is identified. Crops where lack of this important secondary plant food is causing serious inroads on yield and quality include alfalfa, apples, beets, turnips, celery, and cauliflower.

THREE ELEPHANT BORAX will supply the needed boron. It can be obtained from:

American Cyanamid & Chemical Corp., Baltimore, Md.

Arnold Hoffman & Co., Providence, R. I., Philadelphia, Pa., Charlotte, N. C.

Braun Corporation, Los Angeles, Calif.

A. Daigger & Co., Chicago, Ill.

Detroit Soda Products Co., Wyandotte, Mich.

Dobson-Hicks Company, Nashville, Tenn.

Florida Agricultural Supply Co., Jacksonville and Orlando, Fla.

Hamblet & Hayes Co., Peabody, Mass.

Hercules Powder Company, Atlanta, Ga.

The O. Hommel Co., Pittsburgh, Pa.

Innis Speiden & Co., New York City and Gloversville, N. Y.

Kraft Chemical Co., Inc., Chicago, Ill.

W. B. Lawson, Inc., Cleveland, Ohio

Marble-Nye Co. Boston and Worcester, Mass.

Thompson Hayward Chemical Co., Kansas City, Mo., St. Louis, Mo., Houston, Tex., New Orleans, La., Memphis, Tenn., Minneapolis, Minn.

Wilson & Geo. Meyer & Co., San Francisco, Calif., Seattle, Wash.

Additional Stocks at Canton, Ohio, Norfolk, Va., and Wilmington, N. C.

IN CANADA:

St. Lawrence Chemical Co., Ltd., Montreal, Que., Toronto, Ont.

Information and Agricultural Boron References sent free on request. Write Direct to:

AMERICAN POTASH & CHEMICAL CORPORATION

122 EAST 42nd ST. **NEW YORK CITY**

Pioneer Producers of Muriate of Potash in America

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXVIII NO. 6

TABLE OF CONTENTS, JUNE-JULY, 1944

Afterwards 3
Understanding Will Be Called For, Says Jeff

Fertilizer Requirements For Permanent Pastures in Alabama 6
Are Given by E. L. Mayton

Soil Management for Cannery Peas 10
Is Discussed by R. L. Cook

Knowledge of Soils Essential to South 13
H. B. Vanderford Explains Why

Sweet Clover Responds to Potash Fertilizer 19
Demonstration Reported by Wm. A. Albrecht

Our Fertilizers Need Magnesium 20
As David E. Dunklee and A. R. Midgley See It

Fertilizing to Make Water Go Further 25
Is Essential, Says R. E. Stephenson

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

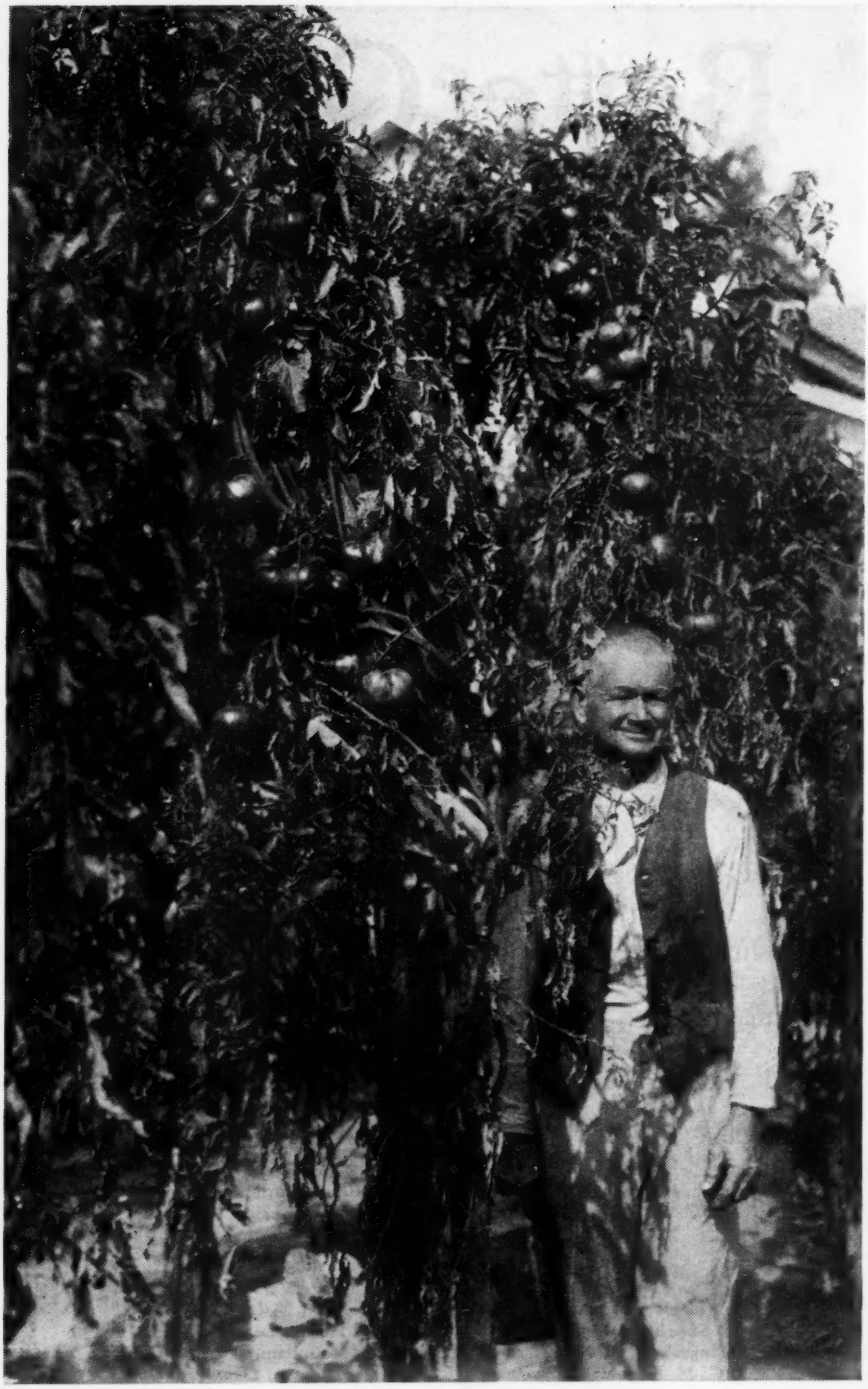
Member Companies: American Potash & Chemical Corporation
Potash Company of America
United States Potash Company

Washington Staff

J. W. TURRENTINE, *President*
J. D. Romaine, *Chief Agronomist*
R. H. Stinchfield, *Publicity*
E. L. Ingraham, *Motion Pictures*
Mrs. C. M. Schmidt, *Librarian*

Branch Managers

S. D. Gray, *Washington, D. C.*
H. B. Mann, *Atlanta, Ga.*
G. N. Hoffer, *Lafayette, Ind.*
M. E. McCollam, *San Jose, Calif.*
E. K. Hampson, *Hamilton, Ont.*



AN INSPIRATION FOR VICTORY GARDENERS.

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1944, BY THE AMERICAN POTASH INSTITUTE, INC.

VOL. XXVIII WASHINGTON, D. C., JUNE-JULY, 1944 No. 6

Getting Set for—

Afterwards

Jeff McDermid

WHENEVER any of us in the family go upstairs and pass his door, we kind of halt in our tracks and almost holler out, in the old familiar lingo, "Hi there, Buddy!" But then we recollect about his being in far-off places away on the other side of that little globe he used to study in grade school and which is still standing over there on top of the set of bookshelves he made in manual arts class when Bugs Hawkins was teacher. Usually we don't spend much time in his old bedroom except when Ma is sweeping and dusting, and wiping off his long row of books, from Doc Doolittle and Huck Finn to his algebra and home radio handbook.

This spring it was pretty late in May before I got in his room to take off the three storm windows and put up the screens, so it pleased me to look out into the mulberry tree which almost taps his window sill, and find a nest of young jay birds stretching up with beady eyes and sharp beaks, all of them fluttering at a gray squirrel that was in danger of being eaten alive by the old birds on the nearest twig.

That reminded me to look for his old bird-observation notebook and feather collection, just one of a whole mess of discarded truck he put back in the closet shelf when he cleaned out the place to make room for his soldier clothes at furlough time.

Before I realized it, the time was passing too fast for me to get all my screens on, and I had burrowed into the closet and poked into a treasure chest of those no-account items which everybody should throw away but no-

body does, until they get you sort of melancholy and dust-choked going through them.

Oh, of course, they're all more or less alike, these mementoes of kid days, only somewhat different than the ones we older fellows hoarded forty years ago. We didn't have those brown blouses, loose scarves, and big hats the Boy Scouts boast about; or the coils of copper wire and screws and plates and tubes for radio tinkering; and we never had such a fine array of snapshots of all the family and the pets and the neighbor kids with icecream cones; or the photos of our old Chevvy parked on Parliament Hill, Ottawa (summer of 1936), or near Bunker Hill monument and the House of Seven Gables (fall of 1937). Moreover, our kid cache held no balsa wood airplane models or mechanical drafting sets either. And jazz-record trading was unknown to us in the stamp-album days.

Browsing into this collection of stowed-away gadgets left there until his return made me kind of absent-minded and moon-eyed for a spell, and I forgot to put in screen bolts which had broken off, and I acted about as careless and dreamy as the boy used to when I set him doing some ordinary earthy job when he had just been learning to identify planes against the sky line.

SO the long and short of it was I just sat down in his old chair that Ma covered with chintz drapes, and I completely lost myself awhile, gazing out westward in the general direction of the Burma Road.

Ma was out for the afternoon working at hospital nurses' aid and bathing cranky patients, so I didn't have anyone to hold the stop-watch on me or to notice (with suspicion) how quiet I was.

Some folks can just sit, but I most always think while I'm sitting. It's a family inheritance, I guess. Thinking comes easier now when almost any old thing is apt to happen to you and yours. You won't catch any of our breed of cats mourning over spilled milk or last year's bird's nest or echoes of old serenades, however.

But a fellow meanders along in his mental processes, tuned a little unconsciously to the spot he is occupying, and weighing the consequences of this or that hazard on the troy weight scales of a feeble mind. You sort of take the past apart like an old watch-works and then see if you can use any of the assortment to patch up a plausible kind of future. All you can go by is what you have lived yourself, and that is a handicap now, because there is so much that is bound to influence public and private affairs which you never understood or took a hand in.

IN our time when we shifted gears from youth to manhood, things were relatively cut and dried for us, because the world was awful big and our spot on it wasn't connected up much with anywhere else. We could quote General George and old Ethan Allen and Davy Crockett and make out a fair rule of living without consulting any oriental oracles or continental wiseacres. If we were foolish we enjoyed it and didn't poke elbows into any quarrelsome neighbors. Maybe it was dross but some of us like to refer to it as the Golden Age, and blamed if I am not glad I was fetched up when there wasn't quite so much general hell-raising. Of course I know our indifference and ignorance was what brought out all this accumulated rash of meanness in human nature today. While we were following the motto of "live and let live," smarter nations were laying secret plots for a set of nose rings and brass collars to hog-tie us with. We should have been packing pistols instead of picking daisies.

Well, this was what began my reverie in the boy's room. I am going to keep on with my daydreams because we are all in the same boat under sealed orders amid sharks and subs. I don't aim to keep my thoughts to myself, because nothing in them will have any remote connection to army secrets

and they wouldn't give the enemy anything but a good laugh.

My first postwar query sounds like this:

(1) Will the absent ones after globe-trotting and flying afar be content to come back home and sell rope, grow corn, pull teeth, and write abstracts of title?

If I can rely upon Bill Galboodle and other dads with lads in service for comparing notes, there is no doubt about the sojourners wanting to return to feather the old nest.

Here and there you'll find a rugged radical who prefers wanderlust and masculine company, bizarre adventure and shifting scenery, but mostly there is a waiting Eve on deck to greet each absent Adam, and few service men will ever surrender their hearts abroad, no matter what else they surrender.

One must allow a period of transition from mustering out to civilian pursuits, a period when the irksome duties and formal conduct of war give way to the freedom and relaxation of normal domestic life. Our boys never did quite so well at lawn mowing and spading gardens during the first few days of vacation, did they? You had to let them go fishing and swimming a while to get the fling of bare feet and unfettered existence. In the same way it isn't going to be wise for us oldsters to begin nagging the kids right away about jobs and humdrum responsibilities.

On the other hand, the solicitude and pride of parents in their returning sons are going to play a part in the outcome. I don't mean mawkish pity and coddling and mushy sentiment, which are dangerous in the extreme. I refer to the countless partnerships in trade, business, profession, and occupation which fathers and sons may continue and probably enrich and broaden because of the enforced absence.

In farming this has particular emphasis. I have seen sons discouraged and disheartened by stubborn attitudes on the part of well-meaning fathers, who refused to change crop rotations, stock management plans, and other programs of a modern kind which youth always wants to follow. Some of these barriers between old and young farmers are bound to vanish when the heroes return. The long and arduous years of hard work and little capable help have taught lessons to the dads which will induce them gladly to hand the reins over to the sons and let them make decisions.

Of course, agriculture won't begin to absorb enough of the veterans directly. We must reckon a lot on the wider use of power machinery, putting larger farms within the grasp of fewer men. But we still have our rural slums to clear, our rural roads to repair and widen and improve, our forests to manage scientifically for the soil's sake, and many other crying needs in sight to occupy the skill of hosts of country lads who cannot find a waiting plow handle.

SO the answer to myself to my first query is "Yes, they'll return and tackle the old tasks, but a whole lot depends on our attitude as well as theirs as to the final outcome."

My second projected proposition is this one:

(2) Will they be hard-boiled and worldly, and want to raise ned and squander their war bonus in riotous living and foolish extravagance?

I smile a little when I recall at this juncture how much hooch and hooray

(*Turn to page* 52)

Fertilizer Requirements For Permanent Pastures In Alabama

By E. L. Mayton

Associate Agronomist, Alabama Agricultural Experiment Station, Auburn, Alabama

A PERMANENT pasture, in the usual sense of the term, is that area of land in a permanent sod of grass or a mixture of clovers [1] and grasses which furnishes some grazing from April to November. From one to two acres of such pasture should be provided for each animal unit.

All pastures should contain an early spring clover such as white clover, hop clover, or black medic. White clover is adapted to the productive and more moist soils in any section of the State. Hop clover is better adapted than white clover to the poorer soils, or where moisture is likely to be limited. Hop has a much shorter growing season than white; therefore, it is less desirable as a pasture plant wherever the latter can be grown. Black medic is well adapted to the lime soils of the Black Belt. It is usually present on these soils and only needs applications of mineral fertilizers to increase its growth.

Clovers are the most important part of a pasture sod because they furnish grazing earlier in the season than do the summer grasses; they are higher in protein than non-legumes, thus furnishing grazing of a better quality; and they take nitrogen from the air and release it into the soil, which increases the growth of the summer grasses. The principle of a productive pasture is the same as the production of a corn crop through the use of winter legumes.

A productive pasture must be on fairly fertile land with favorable moisture conditions. Unproductive land cannot be readily developed into productive pasture.

Since a permanent pasture should contain both clovers and grasses, the fertilizer requirements of the two must be recognized. Legume plants in general respond to lime, phosphate, and potash, while grasses respond principally to nitrogen. As has been pointed out, clover in pastures will furnish nitrogen for the production of a grass crop; hence, the major problem is to supply the fertilizers required for the successful establishment and maintenance of clovers in a pasture sod.

Experiments conducted by the Alabama Agricultural Experiment Station

TABLE 1.—THE EFFECT OF FERTILIZERS ON THE GROWTH OF PASTURE AT TENNESSEE VALLEY SUBSTATION, 1938–41

Rate per A.			Green material per A. 4-year av.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	3,940
2,000	0	0	3,989
0	600	0	4,466
0	600	75	4,884
2,000	600	0	6,457
2,000	600	75	7,622

* Superphosphate.
** Muriate of potash.

[1] In this paper the general term clovers is used to include all legume plants in a pasture sod.

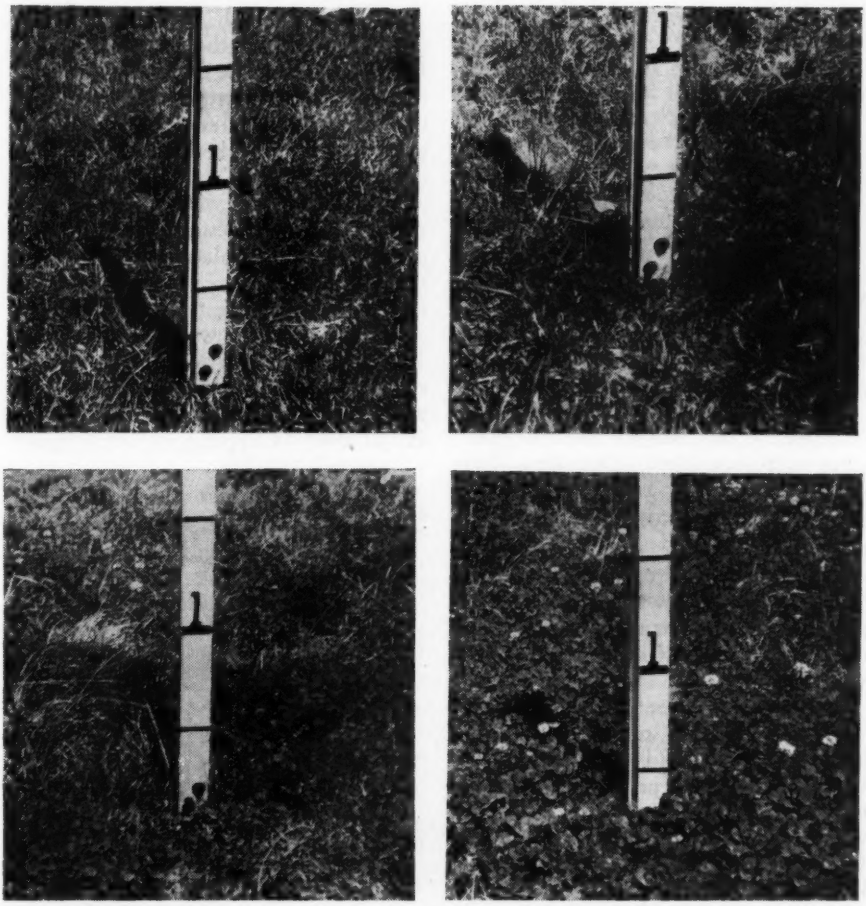


Fig. 1. The effect of fertilizer treatments on the stand and growth of white clover in a carpet grass sod: Upper left, no fertilizer; upper right, lime and potash; lower left, phosphate and potash; lower right, lime, phosphate, and potash.

in nearly all sections of the State very definitely show that lime, phosphate, and potash are necessary for the successful establishment of clover in a pasture sod. The results of some of these tests are presented. In all tests the lime applications were applied at the beginning of the experiment only. Phosphate and potash treatments were applied in the beginning and at three-year intervals thereafter.

The results in Table 1 are from an experiment on the Tennessee Valley Substation, Belle Mina, Alabama. The soil type was Decatur clay loam, which is representative of the better soils of the Tennessee and Coosa River valleys. The use of lime or phosphate alone gave very little increase in growth over the unfertilized plot; neither was there a significant increase in the amount of clover in the sod. The use of lime and phosphate increased the yield 66 per cent, and when lime, phosphate, and potash were used, the yield was almost doubled.

Table 2 is a record of the green grazing produced per acre in a test on the Sand Mountain Substation, Crossville, Alabama. The test was located on good row-crop land of that area. Fertilizer treatments in all cases increased the

TABLE 2.—THE EFFECT OF FERTILIZERS ON GROWTH OF PASTURE AT SAND MOUNTAIN SUBSTATION, 1941

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	2,400
4,000	0	0	3,400
0	600	0	4,750
4,000	600	0	5,250
4,000	600	75	5,712

* Superphosphate.
** Muriate of potash.

yield, and combinations of fertilizer materials produced more than any one material used alone. Where a lime, phosphate, and potash combination was used, a full stand of clover was obtained. However, where only lime or phosphorus, or a combination of the two was used, a full stand of this plant was not obtained.

Another experiment, located near the Tennessee line in northern Madison county, was on land representative of the so-called "Barrens" area. The soil type was Guthrie silt loam. The area was in a heavy sod of broom sedge before it was thoroughly prepared, fertilized, and seeded to pasture in the fall of 1940. The green pasturage produced the following season by some of the fertilizer treatments are given in Table 3.

TABLE 3.—THE EFFECT OF FERTILIZERS ON GROWTH OF PASTURE, NORTH MADISON COUNTY, 1941

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	3,300
4,000	0	150	4,740
4,000	900	0	7,240
4,000	900	150	11,620

* Superphosphate.
** Muriate of potash.

Lime and potash gave a slight increase in yield over the unfertilized plot. Lime and phosphate more than doubled the yield of the unfertilized plot, and the combination of lime, phosphate, and potash increased the yield three and one-half times. On the unfertilized area, almost none of the clovers and grasses seeded was established, whereas, on the lime-phosphate-potash area a good sod of clovers and grasses was established and maintained.

Six experiments were conducted in 1943 on carpet-grass lands in southeastern Alabama. In all instances the areas were fertilized and seeded in the fall of 1942. Clippings of white clover

TABLE 4.—THE EFFECT OF FERTILIZERS ON GROWTH OF PASTURE ON CARPET GRASS LAND, SOUTHEASTERN ALABAMA; AVERAGE OF SIX EXPERIMENTS, 1943

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	2,275
0	900	0	3,100
2,000	900	0	4,675
2,000	0	150	2,200
0	900	150	4,800
2,000	900	150	8,300

* Superphosphate.
** Muriate of potash.

growth from the different treatments were made in the spring and early summer of 1943; the data are presented in Table 4. These results again emphasize the necessity of supplying lime, phosphate, and potash for the establishment of white clover. When one fertilizer material is omitted, it lowers the efficiency of the other two.

While these latter experiments were conducted on sandy soils, Norfolk and similar types, in the southeastern part of the State, the results are equally applicable on the sandy soils lying north of the Black Belt, usually referred to as the Upper Coastal Plain.

TABLE 5.—THE EFFECT OF FERTILIZER TREATMENT ON PASTURE LOCATED ON RIVER TERRACE SOIL, AUTAUGA COUNTY, 1942–1943

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0.....	0	0	9,500
4,000.....	0	0	8,800
0.....	900	0	10,450
4,000.....	900	0	11,900
4,000.....	900	150	15,800

* Superphosphate.
** Muriate of potash.

An experiment was established in the fall of 1941 on a river terrace soil in central Alabama. The data presented in Table 5 are averages of the total growth for the 1942 and 1943 seasons. The clipped material from the unfertilized, lime-only, and the phosphorus-only plots was largely summer grass. The lime-phosphate plot contained some clover, while the lime-phosphate-potash plot carried a full stand of clover in the spring and early summer of both seasons.

Two experiments were conducted on the acid soils of the Black Belt in 1943; the results are given in Table 6. Here again lime, phosphate, and potash were necessary for the best establishment and growth of white clover.

Summarizing the results of all the experiments conducted, applications of lime, phosphate, and potash are necessary for successful establishment and growth of pasture clovers. The only exception to this is on the lime soils of the Black Belt, where only phosphate and potash are needed.

Applications of one ton of lime on sandy soils and two tons on heavier soils will last for at least five years.

Phosphate is the most needed element for pastures. However, it is most efficient when lime and potash are included in the application. Applications of 600 to 1,000 pounds per acre of superphosphate in the beginning will give a better stand of plants than smaller applications. The treatment may be followed with annual applica-

(*Turn to page* 48)

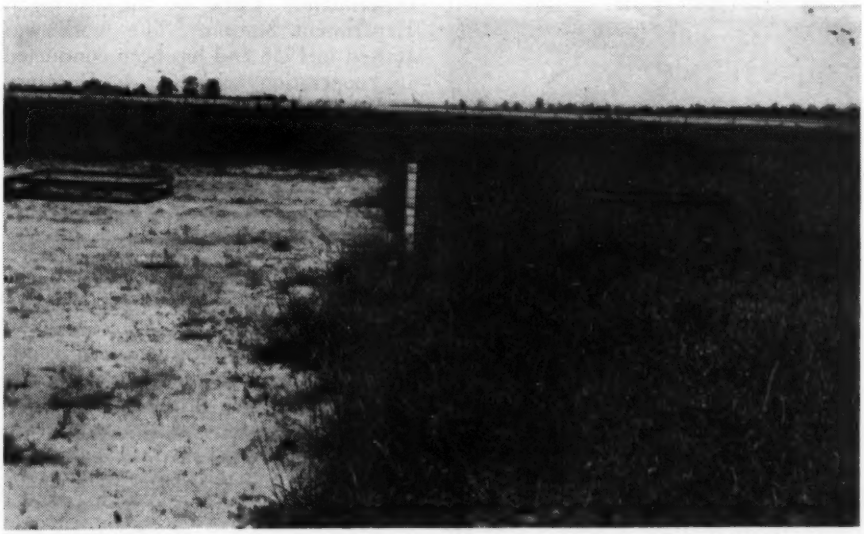


Fig. 2. The effect of fertilizer treatments on the stand and growth of pasture plants on Guthrie silt loam, Madison County, Alabama. Left, no fertilizer; right, lime, phosphate, and potash. Both plots were prepared and seeded alike.

Soil Management For Cannery Peas

By R. L. Cook

Soils Department, Michigan State College, East Lansing, Michigan

Fertilizer in contact with the seed may delay germination and slow up early growth. Left, 4-16-8 at the rate of 300 lbs. per acre in a band beside and below the seed. Right, same fertilizer applied in direct contact with the seed, 40 days after planting.

PEAS grow best on well-drained, fertile loam, silt loam, and clay loam soils. It is desirable to have the crop mature evenly; therefore it is necessary to provide good drainage either through tile drains or a complete system of open drains or dead furrows. Uneven areas that are difficult to drain should not be planted to peas. Likewise, fields containing widely different types of soil are not suited to the production of this crop. Only on relatively uniform fields can one expect uniform maturity.

The seedbed should be firm, smooth, and moist to insure quick and uniform germination and subsequent evenness in maturity. Such a seedbed is easiest to obtain on fall-plowed land. Where peas are grown on heavy, level soils fall plowing may be recommended. Spring plowing should be as early as possible and must be followed by very thorough fitting to obtain a firm seedbed.

Soils should be kept well supplied with organic matter through the use of manures and green manures. Peas are very responsive to improved fertility. The importance of commercial fertilizer has been shown by five years of experimental work at the Michigan Experiment Station. The work was started in 1938 and has been conducted in cooperation with G. A. Cumings and staff of the Division of Agricultural Engineering, Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Department of Agriculture. The Bureau supplied a special type grain drill equipped to place the fertilizer in bands to the side of and below the seed. This drill was also used for placing fertilizer in contact with the seed or drilling it in before planting, the usual methods of application in Michigan. Studies on the effect of fertilizer analyses on the yield of the peas were included in the experiments.

Four different methods of fertilizer placement were tried:

1. Fertilizer in contact with the seed
2. Fertilizer placed in bands ½ inch

TABLE 1.—THE EFFECT OF FERTILIZER PLACEMENT ON THE YIELD AND STAND OF CANNERY PEAS ON THE VANDERMARK FARM IN 1938

Treatment*	Rate per acre	Yield—pounds per acre Stand—plants per 13 feet of row	
		Yield	Stand
"½ inch out"..	300	2,060	88
"2 inches out".	300	2,285	84
Contact.....	300	1,096	41
No fertilizer...	.....	1,424	76

*4–16–4 fertilizer used throughout the experiment. Alaska peas were planted in 7-inch drills at the rate of 4 bushels per acre. The fertilizer was placed in bands ½ inch and 2 inches to the side of the seed and 1 inch below the seed level. The data are expressed as averages of four replications that were arranged as a latin square in the field. The soil was a Brookston clay loam

to the side of and 1½ inches below the seed.

3. Fertilizer placed in bands 2 inches to the side of the 1½ inches below the seed.

4. Fertilizer drilled in deep with a grain drill before planting.

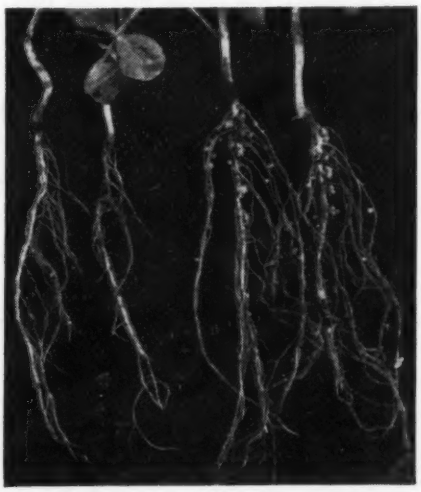
The fertilizers used in the experiments were 4-16-4, 0-20-0, 0-16-8, and 4-16-8 at the rate of 300 pounds per acre for all the mixtures and at 240 pounds per acre for the 0-20-0. The lower rate of 0-20-0 was used to obtain an amount of phosphate equivalent to that applied in the mixed fertilizers.

The rate of seeding was four bushels per acre. Early varieties were grown in 1938, 1939, and 1940 with late varieties grown in 1941, 1942, and 1943. The individual plots were large, and so the threshing was done in a commercial viner by the Clark Canning Company.

All data in the tables are expressed as averages of four or five replications and have been analyzed statistically by the analysis of variance. For all practical purposes, any treatment difference greater than 10 per cent of the average yield of the unfertilized plots can be considered significant.

The results obtained in an experiment on a Brookston clay loam soil in 1938 are recorded in Table 1. According to the data, where 4-16-4 fertilizer was placed in bands to the side and below the seed, there was a slight improvement in stand and a marked increase in yield as compared to the stand and yield on the unfertilized plots. The increases in yield amounted to 861 and 636 pounds respectively for the "2-inch out" and the "½-inch out" treatments. Where the fertilizer was placed in contact with the seed, both the stand and the yield were significantly reduced. The stand was reduced approximately 50 per cent and the yield which resulted was 328 pounds per acre less than that obtained on the unfertilized plots. The yields of the plots where the fertilizer was placed in side bands were approximately double those obtained where the fertilizer was drilled directly with the seed.

The results obtained in 1939 and 1940 are shown in Table 2. During both years, it was evident that fertilizers for cannery peas should not be placed



Fertilizer in contact with the seed may retard bacterial activity and subsequent fixation of nitrogen. Left, 4-16-8 fertilizer applied at the rate of 300 lbs. per acre in direct contact with the seed. Note very few nodules. Right, same fertilizer applied in a band beside and below the seed. Note numerous nodules.

TABLE 2.—THE EFFECT OF FERTILIZER ANALYSES AND PLACEMENT ON THE YIELD AND STAND OF CANNERY PEAS 1939 AND 1940*

Treatment		Horst farm, 1939		J. Gremel farm, 1940	
Placement	Fertilizer	Yield	Stand	Yield	Stand
½ inch out	0–20–0	1,609	293	1,780	245
½ inch out	0–16–8	2,265	285	2,000	231
½ inch out	4–16–8	2,457	280	2,060	235
2 inches out	0–20–0	1,648	273	1,540	254
2 inches out	0–16–8	1,908	287	1,980	261
2 inches out	4–16–8	2,082	277	1,960	247
Contact	0–20–0	1,475	284	1,400	233
Contact	0–16–8	1,571	255	1,600	232
Contact	4–16–8	2,140	270	1,280	184
	No fertilizer	1,905	281	1,080	248

* Yield expressed as pounds per acre and stand as plants per 40 feet of row. Surprise variety planted in 1939 and Wisconsin Early Sweet in 1940. The rates of fertilizer were 300 pounds per acre for 0–16–8 and 4–16–8 and 240 pounds per acre of 0–20–0. The soils on both farms are Brookston clay loams. Treatments were replicated four times in 1939 and five times in 1940.

in contact with the seed. If one groups all fertilizer treatments for purposes of comparison, the plots which received the fertilizer in contact with the seed yielded 1,729 pounds per acre in 1939 and 1,427 pounds in 1940. The corresponding yields for the plots where the fertilizer was placed in a side band 2 inches out from the seed were 1,879 and 1,827 pounds respectively, and where the distance out to the fertilizer was only ½ inch, the respective yields for the two years were 2,110 and 1,947 pounds. Thus it was seen that the fertilizer should not touch the seed, but that it should be as close to it as possible.

The injury to stand was less in 1939 and 1940 than in 1938. There were many plants, however, which had emerged at the time the counts were made and thus were counted as having germinated, but which were so severely injured that they never made a normal growth. In other words, the actual stand-counts shown in Table 2 understate the injury caused by the contact application of fertilizer. The severity of the injury was greatest where the fertilizer was 4-16-8 and least where it was 0-20-0.

In 1939, superphosphate alone actually reduced the yield of peas. When one considers the results from the standpoint of best method of placement ("½-inch out"), the best fertilizer that year was the 4-16-8. The increase in yield caused by the 4-16-8 over the 0-16-8 was, however, only 192 pounds per acre. While this increase would have paid for the nitrogen, the statistical analysis indicates that a difference that small may have been due to experimental error.

In 1940, when total increases in yield from fertilizer were much greater than in 1939, superphosphate was the poorest of the three fertilizers applied. Again, when one considers the "½-inch out" placement, it is noted that the increases in yield favored the 0-16-8 over the 0-20-0 by 320 pounds, but that an application of nitrogen, making the equivalent of a 4-16-8, resulted in an increase in yield of only 60 pounds. Thus it seems that the most profitable fertilizer in 1940 was the 0-16-8.

In 1941, another treatment was added to the experiment, one in which the fertilizer was drilled in 3 inches deep with a grain drill just before planting.

(*Turn to page* 50)

Field in the Prairie that has lost all of the soil and limestone is exposed. One of the old settlers reported that this field was productive before 1860.

Knowledge of Soils Essential to South

By H. B. Vanderford

Associate Agronomist, Mississippi State College, State College, Mississippi

THE cultural developments and the standards of living enjoyed by the people in an agricultural community are governed largely by the soil conditions predominating in that area. There are many economic forces that directly or indirectly influence the overall welfare of every agricultural group, but the possibilities of success or failure depend on the potentialities of the soils.

Observations and studies of soil conditions in relation to economic conditions of the people in the old Asiatic countries, as well as in our own comparatively young nation, have given credence to the old adage that "as the land is, so are the people." Theodore Roosevelt in thinking of the conditions of some of the farmers of the nation once said, "We are founded as a nation of farmers and in spite of the great growth of our industrial life, it still remains true that our whole system rests upon the farm; the strengthening of the country life is the strengthening of the nation." Many modifications and readjustments in social and economic conditions have been traced back to changes in soil conditions. Therefore, every person interested in agricultural development should acquire some knowledge of our greatest natural heritage, the soil.

As long as the farmers of this country were periodic migrators and worked on the philosophy of "wear out a farm, and move to another," very

little knowledge concerning the soils was obtained. As this procedure continued, new land finally became difficult to find. Recent generations of American farmers have realized that they must remain on the same land indefinitely, and their interests in the soil and in the accumulation of useful agronomic information have increased. What one generation learned about the soil, it passed on to the next. Finally the information, gathered by the hard trial and error way, was supplemented with technical facts obtained by scientific studies. From all this knowledge it became apparent that soils could be arranged into groups for study just the same as plants and animals.

Soils are developed by nature and influenced by a number of natural forces which cause them to be extremely complicated, both physically and chemically. Since this is the case, it is understandable that soil scientists have never all agreed, and probably never will, on one definition of the term "soil." Some soil material such as sandstone or limestone is exposed to certain climatic and environmental conditions for a long period of time, and a complicated body called the soil, which has characteristics peculiar to the conditions under which it developed, results. As the conditions change, the resulting soil is modified; and subsequently this natural process gives rise to the many different soils with varying characteristics, crop adaptations, nutrient contents, etc.

From the contributions of the workers in the field of soil classification, soils are classified and identified in the field as natural bodies made up of parts, much the same as we classify animals and trees by the parts comprising the whole. The grouping and separation of the individual soils make possible a basis for accumulating valuable information that is vital to agricultural progress and development. One soil may be a good soil for the production of wheat, another good for cotton, and a third adapted for neither wheat nor cotton, but excellent for the growth of pine trees; just as some cattle are desirable for producing beef and others are suitable for the production of milk and butter. Recent experiments have shown that the supply of available nutrients in a soil not only affects the yield of crops but the percentage composition as well. Thus the health and vitality of animals are influenced by the fertility level of the soil on which they live, and everyone should be concerned with the nature of the soils that support us.

To fully appreciate the soil conditions in Mississippi, one must remember that the Gulf of Mexico once covered the entire State, along with parts of other southern states, and as far north as southern Illinois. The present Mississippi "Delta" was the center and deepest part of the old Gulf. This body of water receded, depositing marine sediments. At a later geological period when the Gulf approached its present position, Mississippi received a blanket of windblown dust which covered a large portion of the State. Hence we have three main divisions of soils in Mississippi, which are the Coastal Plain, Loessial section, and River Flood Plains or "Delta."

Coastal Plain. This is a large area covering approximately half of the State on the east from the Gulf of Mexico to the Tennessee line. The soil materials deposited in this section were sands, clays, and gravel, with the exception of the Prairie Belt. The sand and clay desposits were low in minerals and plant nutrients at the time of deposition, so naturally the soils are deficient in these materials. The excellent physical conditions of a number of the soils of the Coastal Plain cause them to be responsive to good management and fertilizer applications. The topography varies from level land to some of the steepest in the State, and accelerated soil erosion has been quite active on unprotected fields.

Prairie Belt. The prairie is a crescent-shaped and irregular area of land

in the northeastern part of Mississippi and extends from central Alabama to the Tennessee line in North Mississippi. The soil material deposited in this area was soft limestone which gave rise to Prairie-like soil. In general, the soils are high in clay and the topography is gently undulating to rolling. Some of the soils are dark and resemble somewhat, in color, the soils of the midwestern prairie, while the rest developed under trees and are reddish brown and yellow. When Mississippi was first settled, the prairie was one of the most productive sections in the State and was attractive to large plantation operators. The nature of the soil and the systems by which it was managed permitted sheet erosion to take a heavy toll from the fertile land, resulting in badly dissected landscapes and many small farms.

Loessial Section. As a result of glaciation in the northern states, there was deposited over the Coastal Plain area of Mississippi a blanket of Loessial material from the River Flood Plains. The Loessial section, commonly known as the Brown Loam, extends the entire length of the State from the Tennessee line on the north to the Louisiana line on the south. The width of the area east and west varies from 30 to 60 miles. The parent material of this group of soils was made up largely of silt, which was quite fertile and high in lime. The topography varies from gently rolling to very steep and rugged. The looseness of the material on the slopes that predominate in this area causes the soils to be susceptible to severe soil erosion. The texture of the soils would fall in the silt loam class and the color is light yellow to brown. This characteristic color gave rise to the local name of the area "Brown Loam." The soils are easily worked, adapted to most any crop, and responsive to good management. The soil conditions are suitable for diversified farming, and, in some parts, the mineral content is sufficient for the production of clover and grasses required for the highest type of livestock production. In other parts, however, particularly on terrace and bottom soils, the nutrient content is low and fertilizers are required for profitable crop production.

Delta Section. The soil material found in the Delta section was brought in by the Mississippi River from the broad area of country comprising its

A Brown Loam field that has been eroded severely. Scenes like this occur frequently in this area.

A poor, eroded Coastal Plain hill producing vigorous kudzu. This is a plant well suited for eroded sandy land.

watershed. Many variations occur in the Delta soils with reference to texture, drainage, structure, etc., but in general the fertility level of the alluvial soils is higher than that which is found in the hill section. The soils are quite young and the mineral content is sufficient for all local crops. However, recent soil surveys in the Delta show that there are many soils that are developed enough to be classified as terrace or bench soils. Naturally these soils are becoming low in plant nutrients and potash and phosphorus are necessary on some of them for maximum production. There are also many soils along the eastern side of this area influenced by Brown Loam material to such a degree that they respond similarly to Loessial Bottom soils. Large tracts of rich, light alluvial soils are found in other parts, associated with tracts of heavy land locally known as "Buckshot." Since these soils were washed from the plains and slopes of the northern states, it is not surprising that nitrogen is the only nutrient that is seriously deficient. On the basis of the soil types and topography prevalent in the Delta section, the future possibilities for successful crop production seem to excel those of any other part of the State, more especially in terms of the large plantation type of operation.

Cotton is and has been the main cash crop in Mississippi for many years, just as it has been in other southern states. Long before the Civil War large plantations were established in various parts of Mississippi, but according to historical records, the majority of these large agricultural units were concentrated in the Black Prairie, Brown Loam, and Delta sections. There were only a few large plantations ever established in the Coastal Plain section and now almost all of them have disappeared. The plantation economy is still predominant in the Delta section, but is of diminishing importance in the Brown Loam and Prairie areas. The type of farming now practiced on the Coastal Plain soils is largely the small operation type of farming, with cotton and corn as the principal crops. Much of the land has been dissected by accelerated soil erosion and farmers are compelled to digress from the usual type of farming and plant critical areas to perennials crops like kudzu, sericea, and trees. These crops not only protect the soils from further erosion, but

eventually provide some income for the operator. In the Prairie and Brown Loam sections, many of the large plantations have been replaced by dairying, livestock, and small farm operational units. The Delta is at present the predominant plantation area of Mississippi and may be thought of as the super-plantation section of the entire country.

The question may be asked—Why has this recession of plantations occurred from areas where they were once abundant, yet still persist in another area? Recent studies by the Agricultural Economics Department of the Mississippi Experiment Station have shown definitely that this shift from large plantations has been caused by changes in soil conditions to the extent that the producing power of the land will no longer adequately support the plantation type of farm enterprise. The Prairie section, once recognized by its broad uniform areas of land, has been severely damaged and denuded by accelerated soil erosion. There are many acres of once productive land that are now barren and limestone is exposed. These areas are said to have been productive and growing a bale of cotton per acre before 1860. The type of soil conditions now prevailing in much of the Prairie section is not suitable for plantation type of operation. Including non-prairie and badly eroded soils, the cotton production in this area on the acre basis is the lowest of any section in the State. Several large farms that have been under the supervision of one family for many years and protected from rapid erosion are still in a high state of production. The soil conditions now are more suitable for dairying and livestock production, since lime and other minerals are relatively high in the dark soils.

The Brown Loam area has suffered the same fate as the Prairie and the main reason for the disappearance of the large plantation units may also be ascribed to changes in the soil conditions brought about by progressive gully and sheet erosion. Some of the romantic traditions of the "Old South" had their origin around Natchez and many farmers in that section had incomes of from ten to twenty thousand dollars per year. Now the number of large plantations with comparable incomes are

Large, level tracts of productive soils adapted to many crops and types of farm operations are found in the Mississippi Delta.

limited and in their places are untilled areas, small operators, and cattle farms. Fortunately the depth of the soils in the Brown Loam area permits them to be reclaimed in a short time. This gives the small farmers of this section a decided advantage over those on the eroded soils of the Coastal Plain.

The Delta, with its relatively young and large tracts of productive soils, has maintained its plantations and large scale operations throughout all the social and political developments of the past three-quarters of a century. In fact, farm operations of this type have even increased since the Civil War on the alluvial soils, while such operations have declined in other sections of the State. This supports the contention that wherever the soil conditions are favorable, the large-scale operation type of farming will survive, regardless of other forces. Cotton is still the main cash crop, but large quantities of hay and feeds are also produced. No other soil area of the State approaches the Delta in natural fertility.

Need for Fertilizers

As soils develop under humid climatic conditions, there usually is a decided loss of the bases present in the soil material by the process of leaching. The organic content cannot accumulate to any great extent because high temperatures promote rapid decomposition. With this in mind, and remembering too that many soils of the southern states were developed from Coastal Plain materials which had been previously leached, it follows that large quantities of commercial fertilizers should be used to obtain economic crop production.

A survey of Mississippi shows that the use of fertilizers varies with the soil types. As was pointed out above, the greatest natural fertility levels of any soils in the State are found in the Delta, Brown Loam, and Prairie sections. Of course, since the State of Mississippi is located in a region where high temperatures prevail, all of the soils are low in nitrogen. At the present time, nitrogen is about the only fertilizer element used in the Delta section, except on the terrace soils or those that developed from material low in plant nutrients. Large quantities of nitrogen fertilizer are used on cotton, corn, and oats, all of which respond favorably. As some of the soils are cropped for a long period of time and become more developed, the use of potash and phosphorus probably will be profitable. As was stated before, some of the soils because of their environmental conditions or parent material are not only low in nitrogen but minerals as well. The grey soils along the eastern edge of the Delta and some of the terrace soils are deficient in lime, potash, and phosphate. Where these soil conditions are found, complete fertilizers are needed. There are some complete fertilizers used in the Brown Loam and Prairie sections, but not nearly as extensively as in the Coastal Plain. When the water transports the loose, wind-blown material, it seems to suffer a loss of potash. Consequently, the terrace or bench soils of the Brown Loam area respond to applications of this nutrient. Deficiency of potash in these soils gives rise to rust symptoms in cotton fields, which may be corrected by application of potash. Considerable quantities of lime, potash, and phosphate are used on pastures and legume crops grown on the highly leached soils.

The leached Coastal Plain soils which did not inherit much fertility require additional support from commercial fertilizers to produce economical crop yields. Because of the properties of the soils predominating in this section, including favorable physical conditions, the response to complete fertilizer is usually very good. However, a part of the farmer's income has to be absorbed in the cost of the fertilizer. The largest amount of complete fertilizer used in the State is in the lower Coastal Plain section. This is the natural and conse-

(*Turn to page* 45)

Plot 24, Sanborn Field—Late July 1943. Two-year rotation of corn, wheat, with sweet clover as catch crop to be plowed under. Fifty pounds of muriate of potash per acre applied annually on the right, with both the corn and the wheat crops, but only biennially with the wheat on the left. Lime and superphosphate are applied on the entire plot. The plot had received manure, 6 tons per acre 1888 to 1913 inclusive, but no soil treatment 1914-1938.

Sweet Clover Responds To Potash Fertilizer

By Wm. A. Albrecht

Soils Department, University of Missouri, Columbia, Missouri

SOIL improvement by means of legumes is not merely a matter of distributing legume seeds and hoping that this kind of crop will build up the land. Legumes can take nitrogen from the air to add it to themselves only when they find plenty of their other fertility needs supplied by the soil. Lime has become well recognized as one need that we must satisfy by applying it to the soil. Phosphorus is also accepted widely as a soil treatment to improve legume crops. Sanborn Field,* with its carefully recorded experience, is indicating that we may well be putting potassium on the list with the lime and phosphate as an essential help to get stands of sweet clover for soil improvement.

On one of the plots where wheat had been grown for 25 years with manure applied annually, and then for the same number of years without manure, the cropping and soil treatments were changed in 1938 to a 2-year rotation of corn and wheat with sweet clover sandwiched in as a green manure crop for the corn. The soil treatment

(*Turn to page* 49)

*This experimental field of the Missouri Agricultural Experiment Station is one of the oldest fields in the United States. It has been in service now for 55 years.

Our Fertilizers Need Magnesium

By David E. Dunklee and A. R. Midgley

Agronomy Department, Agricultural Experiment Station, Burlington, Vermont

MAGNESIUM deficiency has appeared in a number of Vermont potato fields. Its lack on several farms is known to have caused a reduction in yield to one-third of a normal crop. To one large grower it has meant the loss of at least 12,000 bushels of potatoes in a single season. For about $200 worth of magnesium, he would have saved approximately $9,000 worth of potatoes, since not only yield but quality and size would have been improved. The tops died prematurely, starting with the lower leaves, and the potatoes that grew were disappointingly small. The inclusion of magnesium in the fertilizer on this farm appears to have fully eliminated this trouble.

Cucumber leaves: (top one) plus magnesium; (lower four) no magnesium. Note the prominent green veins and the interveinal yellowing of the deficient leaves, also that the leaves are starting to die around the edges. This trouble is prevalent in Vermont gardens.

A number of other fields up to 20 acres each have shown similar symptoms, and probably other potato fields need magnesium, although they show no marked evidence of this deficiency. In order to notice a magnesium deficiency, it has to be severe enough to practically kill the vines. If the potato grower is to continue to produce crops good enough to pay for heavy expenditures of complete fertilizer, he also must have magnesium. Otherwise, a few poor years will put some growers out of business.

This plant-food deficiency has probably existed unrecognized for some years. The senior author saw a small field thus affected some 10 years ago near Brattleboro, but at that time the cause of the trouble was unknown. He also has seen a number of fields of potatoes where, despite fertilization and good care, the yield was very small. These troubles were undoubtedly due, at least in some cases, to a lack of magnesium, since the potatoes were well fed with ordinary complete fertilizer.

Magnesium is a plant food needed in addition to nitrogen, phosphorus, and potash. Special efforts have not been made to add it to most commercial fertilizers sold in the Northeast, except in Maine. Vermont is a dairy state producing large amounts of manure, often estimated to be four million tons a year. We have been depending on

Magnesium along with high-potash complete fertilizer increased yield of potatoes over 55 bu. per acre on this New Brunswick soil.

this manure to supply needed magnesium, yet it too may be deficient, since this manure mainly derived its supply from deficient soils. Superphosphate often carries some but not anywhere near enough of this plantfood. Few growers realize, however, that magnesium is needed by plants sometimes in amounts nearly as large as phosphorus. In fact, it is the basis around which plants build their green coloring matter or chlorophyl. It is as important to plants as iron in the blood is important to animals.

For the past two years small scale tests of the magnesium requirements of Vermont soils have been under way at the Vermont Agricultural Experiment Station. In pot tests with tomato plants, the addition of magnesium to other fertilizers gave an increase in yield on 15 out of 20 soils tested. Most of the increases in yield were greater than those on the soil where the grower lost 12,000 bushels of potatoes. In general, most sandy soils and some loams gave responses. We do not know enough about our clay soils to know whether they are deficient or not. Adams fine sandy loam gives us particularly severe symptoms of magnesium deficiency. Magnesium was found in greenhouse tests to be one of the elements, along with potash and phosphorus, that was lacking on a podzol soil. It is thus apt to be deficient in all podzol soils because much of their initial supply has undoubtedly been washed away by severe leaching during the process of soil formation.

In a green house test made some years ago on a soil from Bellows Falls, the yields of red clover were increased by the use of magnesium. When the test was made, the results were considered to have only local application, but clover's need for magnesium is now known to be much more widespread.

We have obtained responses in pot tests on a Vermont soil with corn, cucumbers, tomatoes, alfalfa, and garden peas, and while other crops may need it, these are the only crops tested thus far.

A year ago we ran a magnesium spray experiment, putting Epsom salts in the tank of the sprayer each time a grower sprayed his potatoes. The unsprayed vines were visibly very deficient. This grower, a generous user of commercial fertilizer, was in serious trouble on 50 out of 70 acres of potatoes. The average increase in yield from the use of magnesium in the spray was 50 bushels per acre.

A field test with and without magnesium in the fertilizer was also made

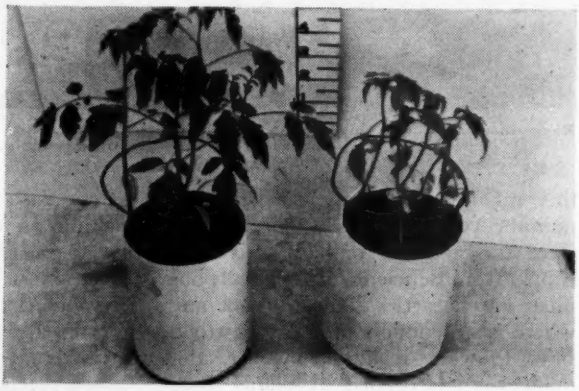
with field beans. The average increase in yield in favor of the added magnesium was 305 pounds of dry beans per acre. This was on Colton fine sandy loam. The cost of Epsom salts used per acre for the beans as we fertilized them was $4.13, with a return of $15.25 if the beans were valued at five cents a pound.

This year we ran a field trial on potatoes, with and without magnesium in the complete fertilizer on a soil we thought might be deficient. The increase in yield from the use of magnesium was 29 bushels per acre, although there were few signs of deficiency symptoms during the growing season.

Potatoes were the first to show magnesium deficiency in Vermont and have shown it more plainly than other crops in the field. For this, there are several probable reasons. Land for potatoes customarily receives very little manure or lime which would supply magnesium, and it receives extra large amounts of commercial fertilizers which tend to replace magnesium from the soil reserve. Some replaced magnesium not needed by the crop is undoubtedly washed away by rain-water. Furthermore, the potato has a high requirement for magnesium and much is taken away in the crop. Growing potatoes for a number of years on the same soil, and growing them on acid loams and sandy loams where the soil supply is none too large, probably contribute to the total deficit.

Magnesium is available in several forms, some of which are more available to plants than others. Some are water-soluble and some are not. Water-soluble forms include Epsom salts ($MgSO_4 \cdot 7H_2O$), calcined kieserite ($MgSO_4$), and sulphate of potash magnesia ($MgSO_4 \cdot K_2SO_4 \cdot 6H_2O$). The more insoluble and slowly available forms include dolomitic limestone ($CaCO_3 \cdot MgCO_3$), kieserite ($MgSO_4 \cdot H_2O$), and magnesite ($MgCO_3$).

To be effective in a fertilizer on Vermont soils, we have found that most of the magnesium should be in water-soluble form, otherwise little benefit will be obtained the year it is applied. The cheapest grade of Epsom salts is suitable and costs us about $2.75 per 100 pounds. The sulphate of potash magnesia, if available, provides magnesium on a still cheaper basis. Last year one manufacturer put the latter form of magnesium into his fertilizer for one dollar per ton extra, to make a 3-10-10-1 fertilizer (containing one per cent of magnesium oxide). It is doubtful if magnesium under present conditions can again be provided for the very low price of one dollar per ton extra.



Tomato seedlings: (left) plus magnesium; (right) no magnesium in the fertilizer. Without magnesium the lower leaves became yellow, shriveled, and died. Untreated plants were much smaller.

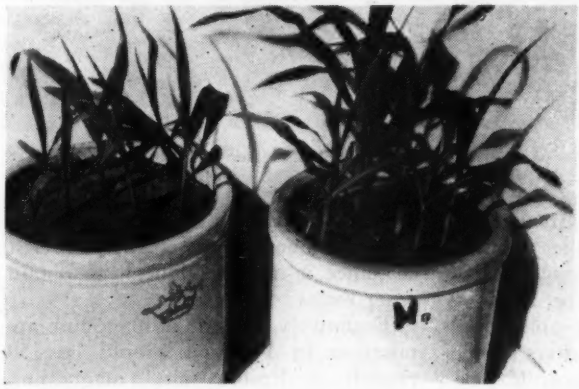
Epsom salts has an analysis of 16% magnesium oxide, calcined kieserite about 30% magnesium oxide, and sulphate of potash magnesia a variable analysis usually about 10% magnesium oxide. Dolomitic limestone often has an analysis of 18 to 20% magnesium oxide.

To supply the same amount of soluble magnesium contained in 150 pounds of Epsom salts, it takes 80 pounds of calcined kieserite, or 240 pounds of sulphate of potash magnesia. Of course

the latter is also an important source of potash.

Dolomitic limestone can be used on acid potato soils at rates usually not greater than 1,000 pounds per acre. On some fields where potato scab is bothersome, it may not be safe to use any lime whatever. It is usually not advisable to lime a potato field above pH 5.4, some say pH 5.1, lest scab become serious.

If the use of magnesium in our fertilizer is greatly increased, we ought to be thinking where the extra supply is to be obtained. Vermont has worth consideration a source of mineral magnesium as piles of talc waste containing hundreds of tons of a mineral called magnesite already mined. More is available as a by-product of the talc industry. In its present form, the magnesite (magnesium carbonate) is not appreciably soluble in water. We have found that in its natural form it is not readily available to plants. This has been determined by pot tests in the greenhouse.



Sweet corn seedlings: (left) without; (right) with magnesium in the fertilizer. Without magnesium the leaves had a wilted appearance and a more or less purple tinge on the upper side. Lower leaves tended to die first, becoming yellow at the tip. Untreated plants were much smaller even at this early stage.

Samples of Vermont magnesite had the following analysis:

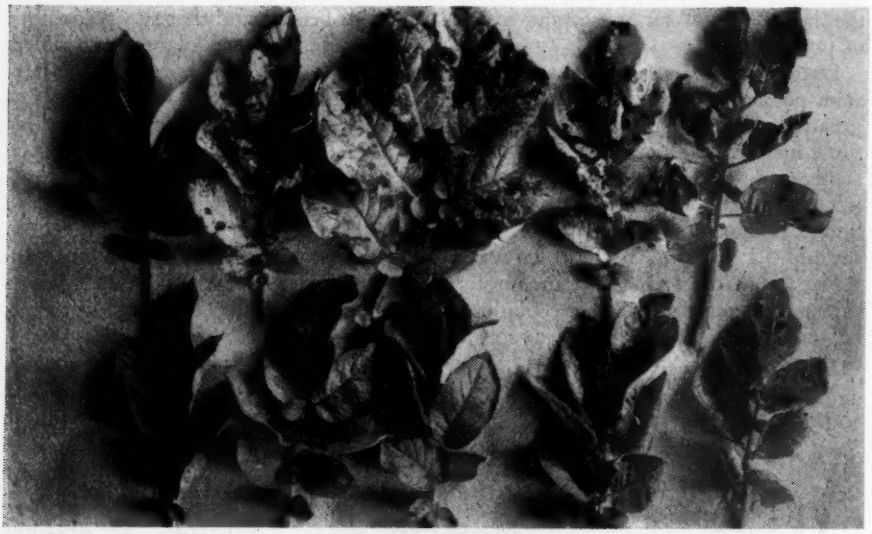
Ignition loss	45.62%
SiO_2	2.95%
Fe_2O_3	10.18%
Al_2O_3	2.69%
CaO	1.88%
MgO	37.0 %

It has been found that the availability of this magnesite to plants is considerably improved by mixing it with fertilizer for a year, but it still does not seem to be enough improved for all crops. It may be useful on acid soils like a liming material, but as yet we have no information about this. We have calcined it (heated it white hot) and apparently not improved its availability for direct application. It seems to become available to plants, however, after it is reacted with sulphuric acid. In this respect, the treatment resembles that of rock phosphate to make it available to plants. Much carbon dioxide and heat are evolved. Magnesium is converted to available magnesium sulphate. Our investigations have not proceeded far enough yet to indicate whether this magnesite can really be made into an economical fertilizer. Other sources of magnesite might be more satisfactory.

We might also expand the use of dolomitic limestone in areas where supplies will permit, because it provides a source of magnesium even though it is only slowly available to plants. Manufacturers should receive a premium for this kind of limestone to encourage them to grind it. Other manufacturers should receive a premium for magnesium-bearing fertilizers.

Dolomitic limestone is ground and available in Vermont at Plymouth and Amsden. However, most of the agricultural lime available in Vermont is of the high-calcium variety. Since our lime-grinding outfits are in the main located on high calcium lime, we will have to depend for some time primarily on sources of magnesium other than dolomitic limestone.

The experimental results obtained well justify the following recommen-



Magnesium-deficiency symptoms on potatoes. The healthy leaves are on the extreme left in both rows.

dations. Until more is learned about the need for magnesium, the Vermont Experiment Station recommends that water-soluble magnesium be included in fertilizers for potatoes and truck crops. Fertilizer manufacturers should note this fact and act accordingly, because they can provide the magnesium at time of mixing cheaper than any other way and it is best fed to plants in this way. They should use whatever source they can best obtain. The use of magnesium is insurance of good crops and no harm is known from its use at rates recommended, even though little or no response is obtained. A small excess of magnesium beyond the needs of the plant is not harmful. We believe it sound business and justified for the best use of nitrogen, phosphorus, and potash, if fertilizer companies will carry out these recommendations as far as possible.

It is recommended that farmers and gardeners purchase magnesium separate and mix it with their fertilizers if they can not buy it already mixed and included. As it is too late to have manufacturers put magnesium in all fertilizers where it is needed this year, some farmers will have to mix their own if they use it. Epsom salts or sulphate of potash magnesia are probably their best bet since it may be difficult to obtain other forms.

Tentatively, the rate of magesium application in Vermont should be 150 pounds of Epsom salts (magnesium sulphate) equivalent per acre. For potatoes, at rates that fertilizers are now used, this magnesium should go into a ton of single strength fertilizer or half a ton of double strength. In an emergency it can be used in a spray, 10 pounds of Epsom salts per 100 gallons of spray, but several sprays will be required. This is all that can be dissolved, and this may tend to plug nozzles because it washes through the strainer on the spray tank none too well.

While Epsom salts is the common form of magnesium that might be used in sprays, sulphate of potash magnesia may also be used in a similar way. However, we have no information concerning this although one large fertilizer company saved out a ton of this material for spray purposes last year.

Another measure that may be taken to increase the amount of magnesium

(*Turn to page* 46)

Fertilizing to Make Water Go Further

By R. E. Stephenson

Soil Scientist, Oregon State College, Corvallis, Oregon

AN average of 500 pounds of water, which must be sucked from the soil by the roots of plants, is required to produce a pound of growth (dry matter). The water needs of plants vary widely, however, perhaps from half of the above figure to two or three times the amount. This variation is in part a plant characteristic, and in part due to differences in soil fertility and other conditions.

Weather in the form of precipitation is not only important for providing water but through the influence of temperature is an important factor in water usage. The U. S. Department of Agriculture in a three-year study found that during one cool season 23 per cent less water was used to make a unit of growth. As air gets warmer, more water can be held in the atmosphere; and when warm air is dry, the evaporation or transpiration from foliage is increased. The rate of transpiration is about in proportion to the saturation deficit existing in the atmosphere. Air at 70° F. that is saturated with moisture will be only 40 per cent saturated if the temperature is warmed to 100° F. The power of the dry air to pull water from the plant is more than doubled by this temperature change.

Cold air will hold but little water and exercises only a small pull on the transpiration stream even when dry. The same temperature change in warming 80° air will cause 20 times as great an increase in the moisture-holding capacity as in warming 10° below zero air. Therefore heavy precipitation occurs in hot climates. The tropical rain forests, which become an impenetrable jungle of growth, are the product of a hot climate and heavy precipitation.

Plant growth is rapid in a hot climate because temperature is an important factor that governs certain plant reactions. Growth is the result of chemical changes that are constantly occurring in the plant. Raw materials, water, carbon dioxide, and nutrients from the soil are made to combine chemically through nature's methods of forming new growth. A law of chemistry says that the rate of reaction about doubles for each 18° F. rise in temperature. This law holds for plant growth provided the necessary nutrients and moisture are present, and sunlight can act upon green foliage. Growth is more rapid with increased temperature until excessive heat or lack of moisture causes injury to the living plant tissue. The same temperature variations, however, affect the growth of different crops to a different degree, because of the variations in the optimum temperature for growth among various plants.

Nutrient Supply

Normally nature supplies the moisture, air, warmth, light, and nutrients from the soil necessary for plants to thrive. Man has a limited control over moisture through drainage, irrigation, and moisture-conserving practices. He has control if he chooses to exercise his prerogative, over the supply of nutrients, by use of fertilizers, humus renewal, and soil-conserving methods. The improvement of the nutrient sup-

ply may be practiced in any area that is suitable for crop production.

Much attention recently has been directed toward this problem. Man cannot eliminate the dry spells except where irrigation water is available, but he can eliminate nutrient deficiencies and enable the plant to use its somewhat limited supply of moisture with greater efficiency. Well-nourished plants may survive a drouth with good yields, where nutrient shortage of even one essential element if severe enough can make it impossible to produce a harvest from the best-watered soil. Moisture and nutrients therefore assume equal significance, and to the extent of his capacity, man should modify both for better yields.

The importance of fertility in efficient water usage has been illustrated many times. A study on Nebraska soils of three grades of fertility, (poor, intermediate, and fertile), showed relative corn yields of 1.0, 1.6, and 2.4, respectively. Relative water usage for a pound of growth (dry matter) was 1.0, 1.2, and 1.4 respectively, or exactly the reverse of the order for yields. When manure was used to improve the soil, yields were in the ratio 1.0, 1.1, and 1.3 for the poor, intermediate, and fertile soils, and water usage for a unit of growth became nearly identical. Thus manuring the poor soil more than tripled the yield, reduced the water required for a unit of growth by more than a third, and water usage became as efficient on the poor as on the fertile soil.

Recently the Indiana Station showed the value of proper fertilization for carrying a corn crop successfully through moderate drouth periods. Making up one nutrient deficiency may increase the yield, but largest yield naturally results when all deficiencies are corrected. In the dry year 1941 nitrogen alone on Vigo silt loam added five bushels to the harvest. Nitrogen, phosphorus, and potassium added more than 18 bushels, doubling the yield. The fertilizer supplied 72 pounds each of phosphoric acid and potash and 41 pounds of nitrogen per acre.

In areas of little rainfall, available nitrogen may be the outstanding soil deficiency. The Washington Station found that with the same moisture maintained in the soil and variable nitrates, the yield of wheat followed nitrates. With 100, 55, 46, and 28 parts per million of nitrate nitrogen in different soils, wheat yields were 45, 35, 32, and 20 bushels an acre respectively. Poor hilltop soils, depleted of humus and nitrogen, responded to nitrogen fertilizer with a 19-bushel increase, bringing the yield to 43 bushels an acre. Washington investigators found that moisture in the surface foot of soil in the fall governed the amount of nitrate to be found in the spring and the yield for the season. With 10.7 per cent moisture, there were 13.8 pounds of nitrate nitrogen an acre and a 20-bushel wheat yield. With 19 per cent moisture, there were 70.5 pounds of nitrate nitrogen and a 49-bushel yield of wheat, thus a close relationship between moisture, nitrate supply, and yield of crop.

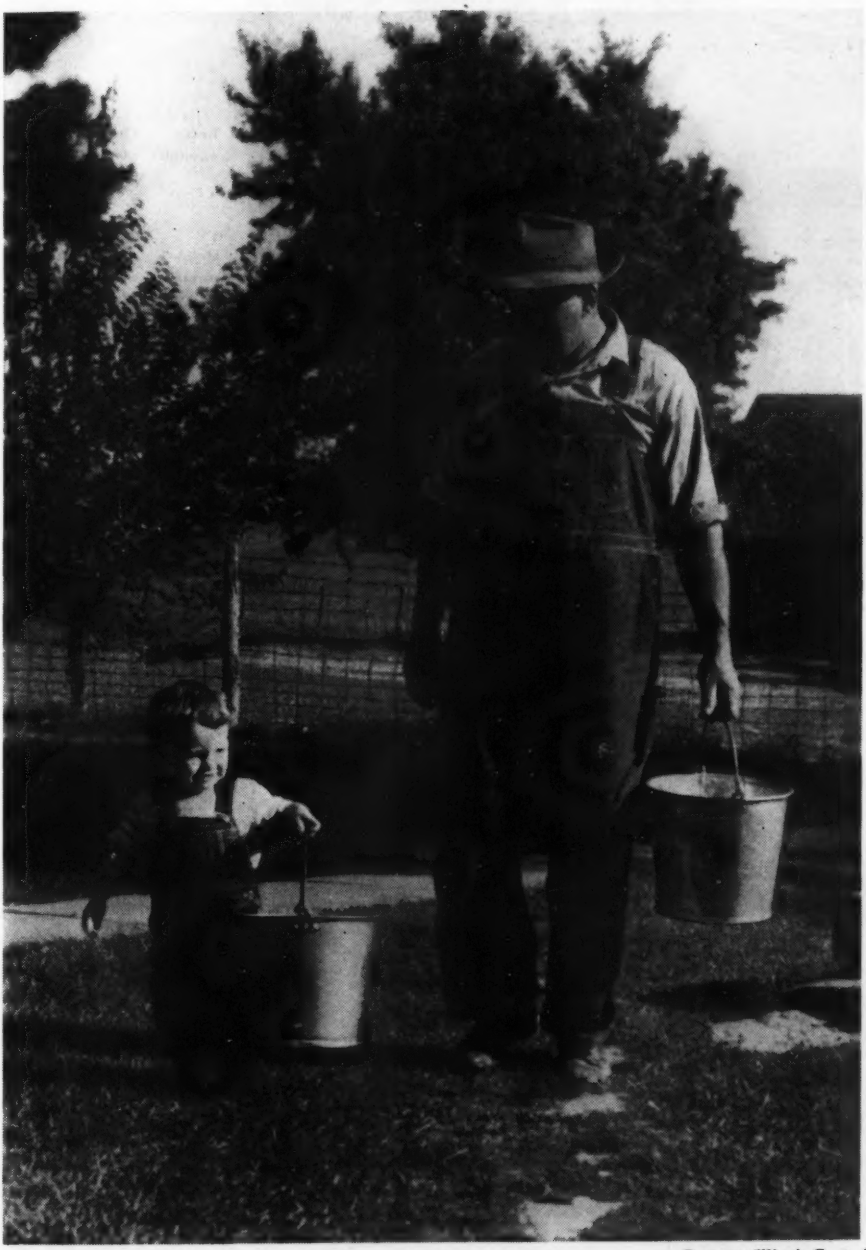
Stored Moisture Is Vital

In a dry country or during dry periods the reserve of moisture stored in the soil becomes important. The crop must draw from stored moisture to carry through the dry period. In eastern Washington with 21 inches annual rainfall, seven feet of wet soil were considered sufficient moisture to produce 50 bushels of wheat per acre if there were no nutrient shortages, or other inhibiting factors.

Eroded soils are usually more subject to drouth injury. Humus and nitrogen are naturally found mostly in the topsoil. When the good topsoil is eroded away, the principal source of nitrogen is lost. Extensive drying of the topsoil aggravates the nitrogen shortage still further, because nitrates are not produced in dry soil and the deep soil though moist contains so little humus that nitrification cannot be appreciable.

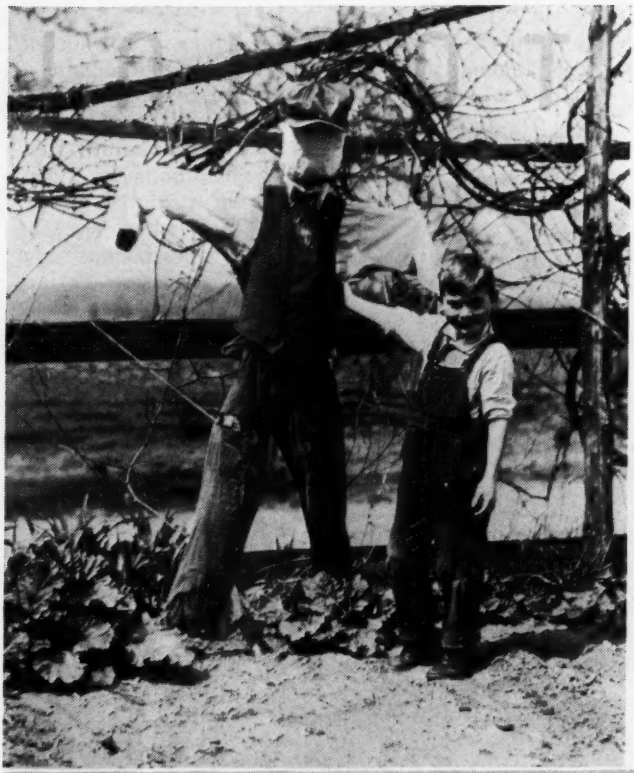
(*Turn to page* 46)

PICTORIAL



Courtesy Illinois Central

EVERYBODY WORKS DURING WARTIME



Left: Almost good enough to scare the worms.

Below: A field of onions near Hadley, Mass.

Right: A hot job in the middle of the day, but—

Below: A beautiful sight when shadows lengthen.

"CORN AND 'TATERS!"

The Editors Talk

This Still Holds True

Browsing among old publications is a delightful and satisfying hobby. Not only will it furnish amusement, but often amazement at the thought given problems which have held over to the present.

One of our readers recently sent us an item which he had found in Volume 1, N. Series of an early agricultural magazine called "The Cultivator" published in 1844 by Luther Tucker, Editor and Proprietor, Albany, New York. He thought we might be interested in presenting this 100-year-old item to our readers. We were, and here it is:

AGRICULTURAL READERS

1844

"In the early part of our experience as publisher of an agricultural paper, we found that the readers of such journals could be divided into two classes, one of which read with profit, the other with very little if any. Of course we do not include in either of these classes, those farmers who already know everything, despise all agricultural reading, and treat the idea of any improvement in husbandry with the most profound contempt. The number belonging to this class is much reduced, but specimens are occasionally met with.

"Farmer A. belongs to the class of readers that receive and peruse agricultural papers with little profit. The reason is, he does not sufficiently exercise his own judgment in reference to the details of farming. He reads a statement that such a farmer was eminently successful in the cultivation of such a crop; the growing or fattening of such or such an animal; or the management in general of a farm on the principles of rotation; and he determines at once to do the same. He does not stop to inquire whether his soil is suited to the particular crop he wishes to grow, whether it is too wet or too dry, too light or too heavy, rich or poor, but pursuing the course pointed out by the successful farmer, he miserably fails in his crop, or his animals, and frequently throws on the publication, or its correspondent, the blame which fairly belongs to himself.

"Farmer B. on the contrary, is one of a class of readers that finds a decided profit in the perusal of agricultural papers. He takes the same papers as A., but wholly escapes the mistakes into which A. is constantly falling. The reason is to be found in the fact that he exercises his judgment in managing his farm; and is fully aware that a course of husbandry that would be successful on one kind of soil, or one particular location, would be ruinous on another. Because a great crop, or fine animals, have been produced under certain circumstances, he does not go on to infer that they will be so in all, and it is in this discrimination and adaptation, that the cause of his success is found. He reads, compares, reflects, and decides whether a course is suitable for him, his soil, or circumstances before he adopts it. His agricultural reading furnishes him the means of doing this correctly, and in that he finds a great advantage.

"Agricultural publications are not intended to supersede the use of the judgment in matters of practice, among those who receive them; their great office is to enable the farmer to judge correctly as to the proper course for him to pursue; to bring to his notice all improvements in husbandry and agricultural implements, that he may choose wisely for himself; to show what has been done by others, and the way it has been done, that if in the same circumstances, and it is desirable, he may do so too; and to excite to improvement by showing it is practicable and profitable. The farmer must do as do men in other cases, obtain all the light and information possible by reading, and then reflect, reason, decide, and practice for himself."

Seeds for Victory

We are hearing much these days about "task forces." Backing up the supreme effort of our armed services, almost every industry has its task forces. One in agriculture for which zero hour is approaching is the Task Force appointed early this year by the War Food Administration to attack the legume seed shortage.

The seed shortage this past spring had reached such proportions that farmers in many sections of the country found it impossible to buy supplies for spring pasture and hay plantings. Part of the shortage resulted from the tremendous demands from England and Russia, but more important, the authorities say, has been the farmer's neglect to cut hay crops for seed. He used his second crop clovers for feed last summer rather than letting them mature for seed.

Statistics show that all big seed production years have resulted from larger than average acreages saved for seed. This means that to increase production this year, farmers must save more acreage for seed. Especially short have been red clover, alfalfa, alsike clover, and Ladino clover. With the feed situation still a critical factor in America's war food production goals, the results of the Task Force on Seed Production will be watched with much interest.

Divided Headline

Were we to open our papers some morning and see a screaming headline—"KILLED 18,000; INJURED 1,500,000"—chances are it would do more than a little to our appetite for breakfast. Yet such a startling fact escapes our notice for the reason that the headline is divided into the thousands of lesser headlines appearing in local publications throughout the country and during a year's time in the reporting of local rural accidents. The figures represent the approximate toll taken every year by accidents to farm people.

July 23-30 has been set aside as National Farm Safety Week. It is a good time to make every rural inhabitant realize the hazards which face farm people 365 days a year. Among other things, the National Safety Council suggests that farmers take steps to eliminate all possible hazards such as loose clothing whenever working around machinery, fire hazards, and obstacles which might cause a dangerous fall.

Publications are being asked to lend their aid in making rural people more accident-conscious. Undoubtedly everyone in the farm advisory groups will add his note of warning in this most commendable project.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....
Index Numbers (1910-14 = 100)									
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191
April	163	229	197	261	177	167	136	243	184
May	160	358	193	269	177	167	135	243	217

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acid-uiated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....
April	.640	2.00	6.10	.535	.797	26.00	.200	....
May	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....
April	119	55	125	75	84	108	83	....
May	119	55	125	75	84	108	83	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought**	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	142	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	157	151	112	100	131	109	80
1926.....	145	155	146	119	94	135	112	86
1927.....	139	153	139	116	89	150	100	94
1928.....	149	155	141	121	87	177	108	97
1929.....	146	153	139	114	79	146	114	97
1930.....	126	145	126	105	72	131	101	99
1931.....	87	124	107	83	62	83	90	99
1932.....	65	107	95	71	46	48	85	99
1933.....	70	109	96	70	45	71	81	95
1934.....	90	123	109	72	47	90	91	72
1935.....	108	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	121	130	126	81	50	129	95	75
1938.....	95	122	115	78	52	101	92	77
1939.....	93	121	112	79	51	119	89	77
1940.....	98	122	115	80	52	114	96	77
1941.....	122	130	127	86	56	130	102	77
1942.....	157	152	144	93	57	161	112	77
1943								
May.....	187	167	152	95	57	160	119	79
June.....	190	168	151	93	57	160	119	69
July.....	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78
November.	194	171	150	95	57	160	119	78
December..	196	173	150	96	57	171	119	78
1944								
January....	196	174	150	96	57	171	119	78
February..	195	175	151	96	57	171	119	78
March.....	196	175	151	97	57	173	119	78
April.....	196	175	152	96	57	172	119	78
May.....	194	175	152	97	57	175	119	78

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Revisions to a Paper Entitled 'Administration of California Laws Relating to Fertilizing Materials,'" State Dept. of Agr. Bul., Sacramento, Calif., 1941, Alvin J. Cox.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended March 31, 1944," Dept. of Agr., Sacramento 14, Calif., FM-83, May 10, 1944.

"Amount of Commercial Fertilizers Used on Various Crops in California during January-June 1943," Dept. of Agr., Sacramento 14, Calif., FM-84, May 15, 1944.

"Tonnages of Mixed Commercial Fertilizers Used in California during January-June 1943," Dept. of Agr., Sacramento 14, Calif., FM-85, May 16, 1944.

"Kinds and Amounts of Commercial Fertilizers Used in California during January-June 1943," Dept. of Agr., Sacramento 14, Calif., FM-86, May 17, 1944.

"Functional Relationships Between Boron and Various Anions in the Nutrition of the Tomato," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 395, Jan. 1944, J. R. Beckenbach.

"Fertilizing Type 62 Shade Tobacco," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Bul. 39, Nov. 1943, J. L. LaPrade and J. M. Carr.

"Fertilizers, Fertilizer Materials and Rock Phosphate Used in Illinois during 1943," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., May 1944, E. E. DeTurk.

"Deep Fertilization," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Agron. Mimeo. No. 47, March 1944.

"Summary of Sugar Cane Fertilizer Tests, Seasons of 1942 and 1943," Agr. Exp. Sta., Univ. Sta., Baton Rouge, La., C. B. Gouaux, M. B. Sturgis, and R. K. Walker.

"Fertilizers for Legumes," Agr. Exp. Sta., State College, East Lansing, Mich., Sp. Bul. 328, April 1944, R. L. Cook and C. E. Millar.

"Results of Cooperative Fertilizer Experiments in Waseca County in 1943," Univ. of Minn., St. Paul, Minn., Soil Series No. 8, Feb. 1944, A. C. Caldwell and C. F. Murphy.

"Results of Cooperative Fertilizer Experiments in McLeod County in 1943," Univ. of Minn., St. Paul, Minn., Soil Series No. 9, Feb. 1944, J. M. MacGregor, C. F. Bentley, and R. E. Jacobs.

"Buying Fertilizer for Cotton in 1944," Agr. Exp. Sta., State College, State College, Miss., Cir. 116, Feb. 1944, W. B. Andrews.

"Soil Treatment to Improve Permanent Pastures," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 289, March 1944, A. W. Klemme.

"Fertilizers for New Jersey 1944," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 475, Jan. 1944.

"Commercial Fertilizers," N. M. Feed & Fertilizer Control Office, State College, N. M., R. W. Ludwick and Lewis T. Elliott.

"Use More Nitrogen to Get More Feed," Agr. Ext. Serv., State Univ., Columbus, Ohio, E. Bul. 248, Feb. 1944.

"Fertilizer Sales in Ohio in 1943," Dept. of Agron., State Univ., Columbus, Ohio.

"The Tennessee Liquid Fertilizer Distributor," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 87, Feb. 1944, M. A. Sharp.

"Commercial Fertilizers," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 505, Aug. 1943, L. S. Walker and E. F. Boyce.

"Fertilizer Tonnage for West Virginia," Agron. & Genetics Depts., W. Va. Univ., Morgantown, W. Va.

"Tobacco Fertilizer Experiments in Dane County," Exp. Sta., Univ. of Wis., Madison, Wis., R. Bul. 149, Nov. 1943, James Johnson and W. B. Ogden.

Soils

¶ Non-technical help for those wanting to evaluate agricultural soils will be found in Publication 748 of the Canadian Department of Agriculture entitled "Guide for the Selection of Agricultural Soils," by P. C. Stobbe and A. Leahey. A map giving the general soil areas of Canada and brief descriptions of the predominant characteristics of the soils in these areas make up the first half of the Bulletin. The latter part discusses briefly such factors as soil texture, color, depth,

parent material, soil structure, reaction, drainage, topography erosion, natural vegetation, and guide to present fertility.

¶ A popular pamphlet effectively emphasizing the importance of maintaining fertility of the soil if good yields are to be obtained year after year has been prepared by the Purdue University Agricultural Extension Service as Leaflet 242, entitled "Feed the Soil to Feed More People." Under the impetus of wartime food goals, American farms are being called on to produce greater quantities of foods, feeds, and fibers than ever before. These heavy productions are making heavy demands on the nutrients in the soil and unless adequate steps are taken to replace these nutrients, farms are going to be seriously depleted by the end of the war. This Circular shows how to prevent such a condition by the proper use of fertilizers throughout the rotation. As a typical rotation, it is suggested that 400 lbs. of 3-12-12 be used for wheat with the legumes subsisting on the residual effects of this fertilizer and a manure top-dressing on the wheat. Manure and fertilizer at the rate of 100 lbs. of 0-12-12 are recommended for corn, and 300 lbs. of 0-12-12 plowed under are recommended for soybeans to follow corn. This completes the rotation. A table showing the net gains or losses in nutrients with various crops is given, and a table of liming recommendations is included.

¶ The boron problem in New Jersey in light of present-day information is thoroughly covered in New Jersey Agricultural Experiment Station Bulletin 709, "The Boron Needs of New Jersey Soils," by E. Reeve, A. L. Prince, and F. E. Bear. At the outset of the work the authors knew there was some boron deficiency existing in the State, but wished to obtain as rapidly as possible some idea as to its extent and distribution. To this end they enlisted the assistance of county agents and utilized easily grown indicator crops. Turnips were selected as well suited for this purpose and small packets of turnip seed were distributed through county agents to various farmers with the request they plant the seed in some of their fields and observe the appearance of the cut roots during the season. As a result of this survey over 14 counties in the State, 42 instances where boron obviously was deficient were observed.

Laboratory and greenhouse work on samples taken from various areas in the State supplemented the survey. In the greenhouse work, the sunflower plant was used as an indicator of boron deficiency. It was determined that .35 p.p.m. of water-soluble boron or 11.2 ounces per acre to the plow depth should be present in a soil if it is to be considered adequately supplied with available boron. On the basis of this classification, 8 of the 20 important soil groups in the State were found to be deficient in boron. No correlation was found between the total and water-soluble boron in the soil.

It had been shown that there was a definite relationship between calcium and boron, an increase in calcium without a corresponding increase in boron resulting in an unbalanced nutrient condition in the plant. The addition of lime did not reduce the solubility of boron in the soil, confirming the authors' opinion that boron-calcium relationship is largely a matter of activity within the plant.

When boron is applied to the soil, part of it is fixed and part of it remains soluble, the latter, of course, being of greatest use to the crop. Heavier soils tend to fix more boron than lighter soils and it is concluded that larger applications of borax will be required to correct boron deficiency on loams than on sandy soil.

It has been well established that some plants require and will tolerate greater quantities of boron than other plants. An investigation of the boron content of 12 plants, with and without borax additions to the soil on which they were growing, disclosed that plants which have a tendency to be easily damaged by excess boron absorbed much more

boron from the soil than did the plants which are not so sensitive and which have a higher boron requirements.

Studies on leaching of boron indicate that there is little danger of any toxic accumulations being built up in the soil as the result of additions of borax in fertilizer. When borax was added to the soil and water equivalent to one-quarter of the annual rainfall in New Jersey was leached through, 75 per cent of the added boron was removed from the heavy soils and 85 per cent from the lighter soils. The application was at the rate of 20 lbs. of borax per acre. This work also suggests the desirability of frequent moderate applications of borax rather than fewer heavy applications.

Investigations on the effect of green manure on soils indicate that if supplies of slightly available boron are present, the decomposition of the organic matter can utilize part of this boron and make it available for crops. This, of course, will not increase the total boron content of the soil and can have little effect on soils where the original total boron content is very low. The boron content of organic matter likely to be added to the soil is so low that the quantities required to supply an ordinary application of 10 lbs. of borax per acre would be larger than would be practical under ordinary conditions.

A number of specific cases of increased yields of crops such as carrots, spinach, red clover seed, alfalfa, and apples are given. The available boron content of numerous important soil types in the State was determined and many of them are lower in available boron than is considered necessary for good crop growth. Even some of the potato soils were found to be lower in boron than the requirement for this crop. Boron-deficiency symptoms on important crops in New Jersey and boron-toxicity symptoms on crops likely to be injured by borax are described. It is stated that some manufacturers are adding borax in all their fertilizer mixtures as an insurance factor, the rate apparently being about 5 lbs. of borax per ton of fertilizer. The authors state that the inclusion of 5 lbs. of borax per ton of fertilizer might be a very helpful way of preventing the development of boron deficiency on New Jersey soils. Where definite boron deficiency is known to exist, it is recommended for most crops that 10 lbs. per acre of borax be used on sandy soils and 20 lbs. per acre on loamy soils, with alfalfa requiring up to 30 lbs. per acre on the heavier soils. In cases of severe deficiency on crops with a high borax requirement, the applications might be doubled, in which case, care should be taken that the borax does not come in direct contact with the seed.

While this Bulletin is intended primarily for New Jersey conditions, the findings and methods of approach to the borax problem can be applied over large sections of North America.

"Arkansas Handbook for Soil Conservation," Agr. Ext. Serv., Univ. of Ark., Little Rock, Ark., Cir. 431, June 1943.

"Soil Management during War," Ext. Div., State College, East Lansing, Mich., E. Folder F-48, Jan. 1943.

"Water Soils in Relation to Lake Productivity," Agr. Exp. Sta., State College, East Lansing, Mich. T. Bul. 190, Feb. 1944, Eugene W. Roelofs.

"Soils and Soil Fertility for Soybeans," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 505, March 1944, Arnold W. Klemme.

"Soils of Meagher County," Agr. Exp. Sta., State College, Bozeman, Mont., Bul. 420, Feb. 1944, L. F. Gieseker.

"Soils of Broadwater County," Agr. Exp. Sta., State College, Bozeman, Mont., Bul. 421, March 1944, L. F. Gieseker.

"Liming New York Soils," Cornell Univ., Ithaca, N. Y., Bul. 78, Feb. 1924 (Rev. June 1943), A. F. Gustafson.

"Comparative Effects of Ammonium Sulfate and Sodium Nitrate on Removal of Nitrogen and Calcium from the Soil," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y. Memoir 252, June 1943, J. A. Bizzell.

"Soil Fertility Studies in the Piedmont," Agr. Exp. Sta., Raleigh, N. C., Bul. 341, Dec. 1943, C. B. Williams, W. H. Rankin, and J. W. Hendricks.

"Soil Fertility Studies with Peanuts," Agr. Exp. Sta., Raleigh, N. C.

"Investigations in Erosion Control and Reclamation of Eroded Land at the Blackland Conservation Experiment Station, Temple, Tex., 1931-41," U.S.D.A., Washington, D. C., T. Bul. No. 859, Jan. 1944, H. O. Hill, W. J. Peevy, A. G. McCall, and F. G. Bell.

"Physical Land Conditions in Schuyler County, New York," U.S.D.A., Washington, D. C., Physical Land Survey No. 31, J. A. Bonsteel and B. J. Patton.

"Farm Planning and Management for Soil Conservation, U.S.D.A., Soil Conservation Serv., Milwaukee, Wis.

Crops

"Fifty-Fourth Annual Report for the Year Ending June 30, 1943," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz.

"Tobacco Substation at Windsor," Agr. Exp. Sta., New Haven, Conn., Bul. 478, Feb. 1944, P. J. Anderson, T. R. Swanback, and S. B. LeCompte, Jr.

"How to Get Good Yields of Alfalfa," Univ. of Ill., Urbana, Ill., E. Cir. 560, July 1943, W. L. Burlison, David Heusinkveld, and O. H. Sears.

"Lespedeza, Its Place in Illinois Agriculture," Univ. of Illinois, Urbana, Ill., E. Cir. 561, Aug. 1943, O. H. Sears and W. L. Burlison.

"How to Grow Better Wheat Following Soybeans," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Leaf. 255, Jan. 1944.

"Food Production for Urban Families," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., E. Bul. 306, March 1944.

"Buffalo Grass," Agr. Exp. Sta., State College, Manhattan, Kansas, Bul. 321, Dec. 1943, L. E. Wenger.

"Report of Progress for Year Ending June 30, 1943," Agr. Exp. Sta., Orono, Me., Bul. 420, June 1943.

"Low-Bush Blueberries," Agr. Exp. Sta., Orono, Me., Bul. 423, Dec. 1943, F. B. Chandler.

"Potato Pointers for Michigan Growers," Ext. Div., State College, East Lansing, Mich. E. Folder 60, April 1943, H. C. Moore.

"Corn Hybrids Compared," Ext. Serv., State College, East Lansing, Mich., E. Folder F-67, Jan. 1944, E. E. Down, J. W. Thayer, Jr., E. Vander Meulan, A. A. Johnson, and H. C. Rather.

"Garden Roses," Agr. Exp. Sta., State College, East Lansing, Mich., Sp. Bul. 222 (Revised), Jan. 1944, C. E. Wildon.

"Growth and Occurrence of Spruce and Fir on Pulpwood Lands in Northern Michigan," Agr. Exp. Sta., State College, East Lansing, Mich., T. Bul. 188, Jan. 1944, A. B. Bowman.

"Effect of a Hydrophilic Colloid of High Viscosity on Water Loss from Soils and Plants," Agr. Exp. Sta., State College, East Lansing, Mich., T. Bul. 189, Jan. 1944, I. M. Felber and V. R. Gardner.

"Seedings in Corn," Ext. Serv., State College, East Lansing, Mich., E. Folder 66, Jan. 1944, H. C. Rather and H. R. Pettigrove.

"Growing Currants and Gooseberries in Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Folder 123, April 1944, E. M. Hunt.

"Growing Grapes in Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Folder 124, April 1944, E. M. Hunt.

"Growing Potatoes in the Home Garden," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Folder 125, April 1944, E. M. Hunt.

"Vegetable Gardening," Agr. Ext. Div., Univ. of Minn., St. Paul, Minn., E. Bul. 174, Rev. April 1944, A. E. Hutchins.

"Growing Sargo for Sirup Production," Agr. Exp. Sta., State College, State College, Miss., Cir. 117, March 1944, I. E. Stokes, W. S. Anderson, and E. B. Ferris.

"Tomato Production in Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 399, March 1944, L. R. Farish, E. L. Moore, and E. A. Currey.

"The Year-Round Home Garden," Ext. Serv., Miss. State College, State College, Miss., E. Bul. 128, Nov. 1943, R. O. Monosmith.

"New Varieties of Tomatoes for Nebraska and their Culture," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. Cir. 1266 Revised, Feb. 1944, E. H. Hoppert.

"Growing Tomatoes in Eastern Nebraska for Commercial Canning," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. Cir. 1269, Feb. 1944, H. O. Werner, M. W. Felton, J. W. Fitts, and H. D. Tate.

"Production of Tomato Plants," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. Cir. 1270, Feb. 1944.

"Wong, A Winter Barley for New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 796, June 1943, H. H. Love and W. T. Craig.

"Care of Plants in the Home," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 623, Sept. 1943, Kenneth Post.

"Report on Peanut Experiments Involving Variety-Fertility Combinations Conducted in 1943," Agr. Exp. Sta. State College, Raleigh, N. C., Agron. Inf. Cir. 135, March 1944, G. K. Middleton, E. F. Schultz, Jr., W. E. Colwell, and N. C. Brady.

"Agronomy Suggestions for May," Agr. Ext. Serv., State College, Raleigh, N. C.

"Fish Production in Farm Ponds," Agr. Exp. Sta., A. & M. College, Stillwater, Okla., E. Cir. No. C-115, April 1944, A. D. Aldrich, F. M. Baumgartner, and W. H. Irwin.

"Alfalfa Varieties and Seed Sources," Agr. Exp. Sta., State College, State College, Penna., Bul. 459, Dec. 1943, H. B. Musser and J. K. Thornton.

"Report of the Puerto Rico Experiment Station 1943," U.S.D.A., Washington, D. C.

"Good Pastures—More Milk," Ext. Serv., State College, Kingston, R. I., E. Mimeo. Cir. 31, 1944.

"Fifty-Sixth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College, Clemson, S. C.

"Feed Production Recommendations for 1944," Agr. College, Clemson, S. C., E. Cir. 255, Mar. 1944.

"How to Produce the Largest Profitable Yields of Cotton per Acre," Agr. College,

Clemson, S. C., E. Cir. 258, Mar. 1944, H. G. Boylston, W. H. Craven, D. R. Hopkins, J. M. Napier, and W. C. Nettles.

"Crop Yields as Related to Depth of Plowing," Agr. Exp. Sta., State College, Brookings, S. D., Bul. 369, June 1943, A. N. Hume.

"The More Important Diseases and Insect Pests of Crops in Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 186, Dec. 1943, C. D. Sherbakoff and W. W. Stanley.

"Pastures for Growing Pullets," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 188, Jan. 1944, Jesse S. Parker and B. J. McSpadden.

"Sweetpotato Culture," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 189, Feb. 1944, Brooks D. Drain, C. D. Sherbakoff, C. A. Mooers, and Ben P. Hazlewood.

"Wheats for Tennessee Growers," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 86, Oct. 1943, C. D. Sherbakoff.

"Abstracts of Bulletins No. 609-624, Circulars No. 95-100, and Other Publications During 1942," Agr. Exp. Sta., A. & M. College of Texas, College Station, Texas, Cir. 103, Sept. 1943, A. D. Jackson.

"Hay Production in Washington," Agr. Ext. Serv., State College of Wash., Pullman, Wash., E. Bul. 304, May 1943, Alvin G. Law and I. M. Ingham.

"Increase Feed," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., M.W.S. 19, March 1944, G. G. Pohlman and J. G. Leach.

"Home Vegetable Gardens," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 254 (Revised Feb. 1943), March 1933, James G. Moore and O. B. Combs.

"Flax in Wisconsin," Ext. Serv., Univ. of Wis., Madison, Wis., Sp. Cir., Jan. 1944.

"Wheat Grading at County Points," U.S. D.A., Washington, D. C., AWI-86, March 1944.

"Production of Carrots," U. S. D. A., Washington, D. C., Leaf. 125, (Rev. Jan. 1944), J. H. Beattie, W. R. Beattie, R. E. Wester, and S. P. Doolittle.

"Production of Peppers," U. S. D. A., Washington, D. C., Leaf. 140, (Revised Jan. 1944), J. H. Beattie, S. P. Doolittle, W. R. Beattie, and R. E. Wester.

"Ratooned S x P Cotton," U. S. D. A., Washington, D. C., Cir. 693, April 1944, R. H. Peebles and H. J. Fulton.

Economics

¶ A record of the agricultural production in Illinois for 1941 and 1942, goals for 1943, expected production in 1944, and maximum wartime agricultural production capacity are given in report AE2094 issued by the Illinois Agricultural Experiment Station entitled "An Appraisal of Maximum Wartime Production Capacity in Illinois." It was prepared by a committee of Experiment Station and U. S. Department of Agriculture members who conclude that maximum production still is required and that land must be utilized to its full capacity, even to the extent of calling on reserve fertility. It is carefully brought out, however, that such a procedure should be undertaken only with the intention of and provision for replenishing this dipping into our reserves when conditions become more favorable with respect to labor and supplies.

Total available land considered suitable for cropping already is largely taken up, so that expansion of production by means of increased acreage is limited. This means that increased production must come about largely through increased efficiency of land already in cultivation. In 1942, a little over 12.5 million acres of crop land were used for intertilled crops and the maximum considered advisable is a little under 14 million acres, the area recommended to be planted during the current year. Corn and soybeans comprise 95 per cent of this acreage. About 5.5 million acres were in grain and fiber crops, with about the same acreage recommended for this year. A little over 6 million acres were in hay and tillable pasture in 1942, and this was reduced to about 5 million acres in 1943. No further cut in this acreage is recommended owing to the requirements for feed in the livestock program. Total crop acreage is about 23.5 million acres with 1.3 million acres not utilized due to one reason or another. The 2 million acres in woodland and 4.7 million acres in permanent pasture are expected to be about the same as in the last several years.

In order to help produce the maximum crops, limestone and fertilizer should be used to the maximum extent available. It is stated that the use of commercial fertilizer has nearly doubled in the last four years, but even larger amounts could be used to advantage. About 2.5 million tons of lime are esti-

mated as the usage in 1943, while 4 million tons should be used for maximum production. Corresponding figures for rock phosphate are 150,000 and 200,000 tons. While 25,000 tons of superphosphate are estimated as the usage in 1943, 40,000,000 tons are needed for maximum production. The use of 2-12-6 can be reduced from 14,000 to 7,000 tons, while 0-12-12 should be increased from 13,000 to 25,000 tons, 3-12-12 from 7,000 to 15,000 tons, 3-9-18 from 5,000 to 10,000 tons, 0-9-27 from 5,000 to 10,000 tons, 0-14-7 from 6,000 to 12,000 tons, 3-18-9 from 3,000 to 10,000 tons and straight muriate of potash from 1,000 to 5,000 tons. The question is raised in the text as to whether farmers would utilize all of these quantities even if they were available without the further educational efforts.

The labor problem is a difficult one, but as a whole it would appear as if there have been no serious losses in production due to shortage of labor, although the limit has nearly been reached in this respect and any further losses in agricultural labor may be more serious in their effect on production.

Many tables on production of crop and livestock products and requirements are given in the publication.

"Avocado Production, Cost and Efficiency Analysis," Ext. Serv., Univ. of Calif., Berkeley, Calif., 1943.

"Citrus Production Costs 1942," Ext. Serv., Univ. of Calif., Berkeley, Calif., 12th A. R., 1943.

"1942 Citrus Production Cost Study, Grapefruit & Lemons," Ext. Serv., Univ. of Calif., Berkeley, Calif.

"Objectives for Canadian Agriculture in 1944," Agr. Supplies Board, Ottawa, Canada.

"Connecticut Vegetable Industry and Its Outlook for 1944," Dept. of Agr., Hartford, Conn., Bul. 85, April 1944.

"Planning for Delaware Agriculture," Ext. Serv., Univ. of Del., Newark, Del., Mimeo. Cir. 29, Dec. 1943, H. A. Johnson, T. A. Baker, E. P. Brasher, Helen McKinley, C. E. Phillips, and G. M. Worrilow.

"Incomes, Costs and Practices on Three Types of Farms Producing Potatoes in Central Maine, 1938," Agr. Exp. Sta., Orono, Me., Bul. 422, Dec. 1943, William E. Schrumpf.

"Costs and Practices in Producing Potatoes in Central Aroostook County, Maine, 1940," Agr. Exp. Sta., Orono, Me., Bul. 424, Dec. 1943, William E. Schrumpf.

"Michigan's 1944 Crops Program," Ext. Serv., State College, East Lansing, Mich., E. Folder F-68, Jan. 1944.

"A Farm Management Survey of Pump Irrigated Farms in Buffalo County," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Bul. 358, Jan. 1944, Arthur W. Peterson.

"Factors Influencing Farmers' Attitudes Toward a Cooperative Marketing Organization," Agr. Exp. Sta., State College, Pa., Bul. 457, Nov. 1943, M. E. John.

"Report on the Possibilities of Utilizing Navy Lands in Vieques Island for a Resettlement Project," Agr. Exp. Sta., Univ. of P. R., Rio Piedras, P. R., Mimeo. Rpt. 23, Oct. 1943.

"Farm Management Analysis of 107 Farms on the Cumberland Plateau," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., R. Res. Series Mon. 165, Feb. 1944, Edmund J. Lebrun.

"The Economics of Certified Seed Potato Production," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 504, June 1943, J. A. Hitchcock.

"Northeast Agricultural Atlas," U. S. D. A., Washington, D. C.

Will It Rain Tomorrow?

FORECASTING the weather is one of the rural arts. Anyone who would forecast skilfully must first become alert for weather signs. Important among these signs are the direction of the wind, the kind of clouds, the speed with which smoke rises, the appearance of the sky, the behavior of animals, and changing wind directions.

Growing out of this art of weather forecasting, we have many weather proverbs and sayings that have withstood the test of time. No doubt all of these proverbs had some value in their original setting. Many which have rather wide application are worth remembering.

Probably of prime importance are those that will help us forecast tomorrow's weather. One jingle sums up

many of the signs of tomorrow's weather, all of which forecast rain:

"When the sky is red in the morning,
And there's a rainbow before noon;
When the stars are ghostly dim and dull,
And a ring forms 'round the moon;

"When the crows caw long and loudly,
And the flies stick tight and bite;
When fish jump from the water,
And sounds travel far at night;

"When you can't get salt from the shaker,
And your corns give you extra pain;
There's no need to consult an almanac,
You just know it's going to rain."

Now let's examine the weather signs listed in the jingle. A red morning sky indicates a moisture-laden atmosphere and an overcast sky, conditions which usually precede a stormy period of considerable duration.

Another way of saying this is found in the Bible:

"He answered and said unto them,
'In the morning ye say,
It will be foul weather today
For the sky is red and lowering'."

When a rainbow appears in the morning, we have the sun in the East shining through the raindrops in advance of the shower.

"Rainbow in the morning,
Shepherds take warning."

Since most showers approach from the West, a rainbow in the morning across the western sky could hardly foretell anything except an approaching storm, and one that is likely to occur within the next few minutes. Surely there is neither need nor time to consult an almanac when there is a rainbow in the West. Few signs foretell immediate rain better than a morning rainbow.

"When the stars begin to hide,
Soon the rain will betide."

At night our first indication of moisture-laden dust particles in the atmosphere is often the gradual disappearance of the stars. The dim stars disappear entirely; the bright ones fade, become ghostly dim and dull, and look as though they were farther away.

"The bigger the ring,
The nearer the wet."

This phenomenon of the circle around the moon is caused by the re-

fraction of light on the clouds through a moisture-laden upper atmosphere. An atmosphere laden with moisture and gathering clouds certainly presages rain.

The next verse of the jingle about the crows cawing, the flies biting, the fish jumping, and the sounds travelling far, as well as the first two lines of the last verse, refers no doubt to the lower pressure that accompanies a moisture-laden atmosphere. Probably "your corns do give you extra pain" when the atmospheric pressure falls suddenly, as it usually does before an approaching storm. That the flies bite and the fish jump when a storm approaches are matters of common observation.

"When the forests murmur
And the mountain roars,
Then close your windows
And shut your doors."

Without doubt, in a moisture-laden atmosphere sounds travel far and wide. Sounds seem hollow, the forests sigh and moan, and the trees murmur.

Other weather proverbs that tell much the same story are:

"A coming storm, your shooting corns presage."

"When the mists creep up the hill,
Fisherman up and try your skill;
When the mists begin to nod,
Fisherman then put by your rod."

"When the smoke goes east,
Good weather is neist;
When the smoke goes west,
Good weather is past."

"Rain long foretold, long last.
Short notice, soon past."

But the best of all the weather proverbs is the one which gives you divine protection if you would foretell the weather, and sometimes you will need this protection for the weather signs are only relative, not absolute:

"When God wills, it rains with any wind."

—*L. H. Woodward, Elmira, New York.*

Boron and Fertilizer for Turnips

APPRECIATING the value of good turnips as a table vegetable, I had a bushel of supposedly first-grade table turnips delivered to my home. The turnips, when cut open, showed the familiar dark brown, water-soaked areas symptomatic of boron deficiency. Some were pithy, and all were of poor quality and flavor when cooked. Those kept in storage soon began to rot.

It may be true that turnips are 90 per cent water, but I agree with the Scot who said, "Aye, not water, but turnip juice." What can be more tempting after a hard day's work than a good slice of roast beef nestling in the amber of mashed turnips?

Since I knew the grower of these turnips, I thought he might be interested in learning of their quality and that he might be induced to try out some remedial measures. He agreed to follow my advice in growing his next crop and on June 24, 1943, the field was ready to be plowed.

By means of a fertilizer attachment, 375 pounds of 2-12-10 fertilizer were placed in the furrow bottom in a band. To this had been mixed sufficient boron to provide 20 pounds per acre. The field was sown a few days later.

Owing to the lateness of the season and the subsequent unfavorable weather, growth was slow and uneven. The farmer was discouraged with the prospects of a crop and had it not been for pressure of work on other parts of his farm, would have plowed up his turnip field. Even a confirmed gambler would not have given five dollars an acre for the crop. But weather conditions finally improved and the turnips began to show signs of life. Growth was rapid and continued right

up to the time the crop was harvested.

During the latter part of October yields were taken and amazing differences were found. On the area treated with fertilizer and boron, 24.1 tons per acre were harvested, while on the untreated area only 13.5 tons were harvested.

Not only was the yield almost doubled by the fertilizer-boron treatment, but the familiar water-core of the previous years was entirely absent in the boron-treated plot. On the untreated plot, it was found that 9 out of every 10 turnips cut open were affected with water-core of varying degrees of severity.

The area sown to turnips was slightly more than an acre of ground, and the owner estimated his net income at $800, as his whole crop sold at $1 per bushel. He admitted, however, that he was not selling the turnips from the untreated area locally. I secured my supply from him, and found every turnip of excellent quality.

The use of the attachment designed for placing the fertilizer in a band on the bottom of the furrow is certainly to be recommended for crops such as turnips, and it is believed that full effectiveness of the boron will be obtained by this method of application.—*W. B. George, Soils Department, Kemptville Agricultural School, Kemptville, Ontario.*

Knowledge of Soils Essential to South

(*From page* 18)

quent result of soil conditions common in this area where the soils have reached an advanced stage of development, and the large quantity of fertilizer used annually throughout the southeast is man's effort to overcome the havoc wrought during centuries of time.

Proper land-use planning in the South is a rather difficult problem because of frequent variations in the soils on individual farms. Rotations as practiced in the Corn Belt are not feasible under southern conditions because of difficulties encountered in maintaining a base number of acres in the cash crop. Most of the farms are made up of several different soils, and some lands are better adapted to one crop than to another. Because of mechanical difficulties, soil variations, etc., the farm operator must devote a part of the farm to crops like kudzu, sericea, grasses, or trees for several years and at the same time maintain the fertility of the land planted to row crops. Hence the problem of rotations and proper land use, and at the same time making a living on the farm, is a very grave one.

The Soil Conservation Service has stressed the point for several years that every acre of land on a farm should be used in some way to contribute to the income of the farmer. Wise land use and soil conservation are synonymous and much has been done along this line during recent years by the Conservation Service and cooperating agencies. Much more still remains to be done before the farmers of the South can enjoy the happy and healthy life to which they are entitled. It has been said that the Cotton Belt is the No. 1 problem area of the country. It is a problem area not altogether because of a one-crop system, freight rates, social disorders, or other man-made conditions, but primarily because of the soil conditions prevalent in this region.

In order to improve and make the most of the situation, the first prerequisite is a basic understanding of the soils and their limitations. May the day soon come when the different soils of the country will be appreciated and understood so that agricultural production may be planned according to the potentialities of the soils rather than the fancies of the people.

Our Fertilizers Need Magnesium

(*From page* 24)

received by the plants is the use of dolomitic hydrated lime in the potato spray, in place of the high calcium hydrate most commonly employed, although it may make spraying more difficult. Magnesium should not be omitted from the fertilizer even where the use of dolomitic hydrate in the spray is adopted because in severe cases, sprays do not seem to feed the plants well enough.

Magnesium can be provided for the crop over a long period of time by the use of dolomitic limestone, but it does not always provide for the immediate needs of the current crop because of its slow availability. It should be used on potato land which is acid and needs lime and as a conditioner in mixed fertilizers to decrease their acidic effect upon the soil.

When Dr. Chucka of Maine was in Vermont two years ago, he made the remark that the magnesium deficiency that he saw in Vermont potato fields was as severe as any he had ever seen in Maine. He referred in particular to Maine outbreaks in 1933. He confirmed the Vermont diagnosis of magnesium deficiency of potatoes and he also indicated that practically all of the potato fertilizers sold in Maine two years ago contained magnesium at the insistence of growers. Vermont now similarly becomes a state where growers should ask for magnesium in their fertilizers to be certain of a good crop.

Magnesium deficiency is not a new trouble. It is apparently an old trouble slowly aggravated. Some of the worst cases have occurred on long-cropped acid soils, although it is now known that some practically virgin soils need magnesium almost as badly. The proper idea in fertilizing crops is a balanced plant food. We have learned that on many of our soils the plant food is not fully balanced without this magnesium.

Last year (1943) more than 540 tons of fertilizer containing soluble magnesium were sold in Vermont through the cooperation of the Vermont Station, fertilizer companies and other agencies. Because growers reported excellent results last year and because of new evidence obtained, more than 900 tons containing magnesium will be used this year. The day may well come when nearly all of the mixed fertilizer used in Vermont will contain magnesium.

Fertilizing to Make Water Go Further

(*From page* 25)

In the corn belt eroded soil in a dry season results in "firing" or burning of the foliage, a characteristic symptom of nitrogen deficiency.

The Indiana Station prevented the firing of corn and added 28 bushels to the yield on sandy soil by plowing under fertilizer, supplying 80 pounds of nitrogen an acre. The plowing under was important because it placed the fertilizer down where the soil was moist. Fertilizer placed in the dry topsoil would have little value unless rains supplied moisture to allow plant roots to function in absorbing the nutrient. "Plowsole" application at the Indiana Station was still more effective than plowing under. This deep placement reduced fixation of phosphates and potash, as well as assured contact with moist earth. The plowsole placement of complete fertilizer sometimes added

10 or 12 bushels to the yield, compared to plowing under. An additional light application in the row helped when moisture conditions were favorable.

The importance of correcting all deficiencies is indicated by Indiana corn yields on Vigo silt loam. Fertilizer to supply 80 pounds of nitrogen broadcast and plowed under yielded 27 bushels, but 80 pounds each of nitrogen, phosphoric acid, and potash broadcast and plowed under yielded nearly 57 bushels an acre. The same fertilizer treatment using the plowsole method of application yielded 69 bushels in a year when the growing season was described as extremely drouthy. These yield responses are sufficient evidence of the importance of soil fertility in increasing the efficiency of water usage by the growing crop in dry seasons.

In another study in Washington sulfur was the limiting nutrient supplied by the soil for alfalfa production. Without treatment the yield was 1½ tons an acre, but with 200 pounds of landplaster the yield became 4½ tons an acre, with similar moisture conditions in the soil in both cases. Oregon soil deficient in boron, in greenhouse studies, refused to respond to complete fertilization including sulfur. When the boron was supplied, the yields were about tripled. Moisture was controlled so that water was not a limiting factor in either case.

When moisture is very limited, as in dry farm areas, there is a nice balance between too much and too little fertility. Wheat after alfalfa in Washington yielded 38 bushels an acre. By spreading straw on the alfalfa before plowing so that some of the excess nitrogen from the alfalfa would be used in rotting the straw, the wheat yield was boosted to 42 bushels an acre. The excessive nitrogen under the alfalfa sod made too much wheat foliage and the limited moisture was dissipated in growing foliage to the extent that the yield of grain was cut; therefore a better yield was obtained with less available nitrogen. In another study, the reverse situation was apparent. Wheat grown after wheat required 487 pounds of water to make a pound of growth, whereas wheat after clover, with more available nitrogen, required only 310 pounds of water for a pound of growth, indicating the value of improved fertility for increasing the efficiency of water usage by the crop.

The limited precipitation which may produce satisfactory harvests when the soil is of excellent quality in both physical and chemical properties is sometimes surprising. An orchard area in eastern Oregon on good soil produces four to six tons of cherries an acre, and up to seven or eight tons on the very best soils, where the precipitation for the last 20 years averages only 12.7 inches, only 2.2 inches of which falls in the six months April to September inclusive. And there is never a complete failure in spite of years like 1935 with 6.9 inches and 1939 with 6.4 inches of precipitation. These were hard years but there was a crop, and without irrigation. Only because of the excellence of the soil are the trees still alive and productive.

Water Requirement for Corn

But an adequacy of both moisture and fertility with favorable temperature conditions is necessary for maximum production. The Indiana Station estimates that 20 inches of water for the use of the crop would be sufficient to produce 100 bushels of corn an acre if all nutrient deficiencies in the soil and other inhibiting factors were eliminated. This estimate is equivalent to the production of a pound of growth (dry matter) with about 375 pounds of water, which is a reasonable figure.

The Willamette Valley in the vicinity of Corvallis has normally about 40 inches of rain. The best soils will hold nearly two inches of usable or crop water for each foot of depth. Most of the precipitation occurs outside the growing season, therefore effective soil depth has outstanding significance. Ten feet of storage depth in the soil would hold 20 inches of crop water sup-

posedly enough for a 100-bushel corn yield could the crop send its roots into the deep soil to secure the stored moisture. But the cool climate, not ideal for corn, probably makes such a yield impossible even with adequate moisture and a fertilizer program to eliminate nutrient deficiencies. Other crops, however, that are adapted to the climate, of which the English walnut is an example, can send absorbing roots 10 feet or more into good soil for the stored moisture. Yields up to 3,000 pounds or more of excellent nuts an acre have been obtained on the best soils.

Fertilizer work on this type of crop is just beginning, but there are indications that the correction of nutrient deficiencies, boron, nitrogen, sulfur, phosphorus, potassium, or whatever they may prove to be, will contribute to a more efficient use of the limited summer moisture supply and bring increased production and profits for this and other crops.

Man can correct a water shortage by irrigation in some areas. He can modify temperature in a small way as is sometimes done in orchard heating. He may deepen the soil somewhat by drainage and improve it with crop rotations that include legumes for nitrogen and humus renewal. Anywhere that crops are grown it is possible with well-selected, properly placed fertilizers for him to correct all nutrient deficiencies. Thereby he can make a limited supply of moisture go further, or in the more favored areas enable an adequacy of both moisture and nutrients to yield the maximum harvest.

Fertilizer Requirements for Permanent Pastures in Alabama

(*From page 9*)

tions of 200 to 400 pounds per acre, or the original applications may be repeated every two to three years. If the 600-pound rate is used, it should be repeated every other year.

Potash has been found to be essential in nearly all experiments. Applications are made at the rate of 50 pounds of muriate of potash per acre annually, or multiples of this amount may be used at two- or three-year intervals. The mixture 0-14-10 may be used to supply both phosphate and potash. This material is used at a rate to supply the approximate equivalent of the recommended amounts of phosphorus and potash.

TABLE 6.—THE EFFECT OF FERTILIZER ON GROWTH OF WHITE CLOVER ON ACID BLACK BELT SOILS, 1943

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	625
0	900	0	1,157
4,000	900	0	3,157
4,000	0	150	2,563
0	900	150	2,000
4,000	900	150	5,136

* Superphosphate.
** Muriate of potash.

Soil Preparation and Seeding

Experiments to determine the amount of preparation for pastures show that some preparation is desirable. Where an area is being cleared for pasture, preparation is almost always necessary. This is done in late summer, and the fertilizer application is worked into the soil during the process of preparation. Planting is done on a firm seed bed in September or October, covering the seed lightly. A cultipacker is an ideal tool for getting a seed bed in condition and for covering seed.

The effect of soil preparation on the establishment of white clover in a carpet grass sod. Both plots received lime, phosphate, and potash treatment and same seeding. Left, thorough preparation; right, no preparation.

If clovers are to be seeded on an established grass sod, the fertilizer treatments should be broadcast and disked in during late summer or early fall. It is not necessary to destroy the sod. Dallis grass sod should not be destroyed; however, it is desirable to destroy sods of carpet grass and broom sedge.

Clovers are seeded in October after the soil has been firmed either by rain, or a roller or drag. They are covered very lightly. It should be remembered that clover seed are very small and the young plants cannot become established if covered too deeply, or if they have too much competition from other vegetation.

Sweet Clover Responds to Potash Fertilizer

(*From page* 19)

of lime was put on the entire plot. Superphosphate at the rate of 150 pounds per acre and muriate of potash at 50 pounds were applied with the drilling of the wheat. When the corn was planted, an additional 50 pounds of muriate of potash were put on only the right half of the plot. The seeding of sweet clover that follows the wheat is now demonstrating the value of this extra potash by the successful stand of this legume in contrast to its failure where this additional potassium was not applied.

The significance of the extra potassium as a soil treatment for sweet clover after its applications in only three rounds of the rotation is evident from the growth of this crop in the stubble in late July. Though there were small sweet clover plants where lime, phosphate, and lesser amounts of potassium were applied, the contrast between them and those where potassium was more generously used is so marked that one would not be encouraged to expect much green manure effect by the sweet clover for the corn next spring in that part of the plot where the smaller amount of potassium was applied.

With wheat grown on this plot for 50 years, with all the straw as a rela-

tively concentrated carrier of potassium taken off annually, and with no manure going back to return potassium in the straw as bedding or in the animal urine, this plot has developed a distinct shortage in its potassium delivery for sweet clover in a 2-year rotation. This shortage occurs for a crop not commonly considered sensitive to potassium deficiencies when it may be seen growing on a pile of crushed limestone. The shortage in this plot, however, is so severe that the spring-seeded sweet clover was starved out by the first of August except where extra potassium was supplied.

Here in this plot and its soil treatment there is evidence that our legume program, which we commonly grant needs help in the form of lime and phosphate as soil treatments, may well be looking forward to other helps such as potash fertilizer if we are to nourish these legume crops properly so they can fertilize our soils by means of the nitrogen they take from the air and by their organic matter when they are turned under as green manure.

To date no studies of the chemical composition of sweet clover in relation to soil treatment have been made, such as have been carried on with lespedeza to connect the soil treatments with the improved feeding value of the forage. When potassium now used in a more limited way is tried by more farmers, their observations on animal choices of sweet clover with different fertilizers may help to make sweet clover of better feeding value, in addition to giving it the unusual green manure value it already has.

Soil Management for Cannery Peas

(*From page* 12)

The data in Table 3 show, however, that yields where the fertilizer was so applied were lower than those obtained where the fertilizer was placed in bands ½ inch to the side and 1½ inches below the seed. In agreement with previous years' results, it was found that fertilizer placed in contact with the seed injured germination and did not materially increase the yields. In fact, where 4-16-8 fertilizer was applied with the seed, the yield was less than where no fertilizer was applied.

The effect of 300 lbs. of 4-16-8 applied in a band ½ inch to the side and 1½ inches below the seed in 1943.
Left—no fertilizer; 2,776 lbs. per acre.
Right—fertilized; 3,272 lbs. per acre.

After four years of experiments, a summary of the results led to the conclusion that fertilizer should never be placed in direct contact with the seed of canning peas but that it should be placed very close to the seed. As there seemed to be sufficient evidence for this conclusion, the work in 1942 and 1943 was limited to a comparison between the "½-inch out" band placement and the "drilled-in" placement.

Owing to extremely wet weather prevailing during the latter part of the growing season of 1942, no increase in the yield of peas was obtained from the use of fertilizer. The plants on the fertilized areas had a greater amount of vegetative growth, but lodging and rot-

TABLE 3.—THE EFFECT OF FERTILIZER ANALYSES AND PLACEMENT ON THE YIELD AND STAND OF CANNERY PEAS IN 1941, 1942, AND 1943*

Average of five replications

Treatment		H. Gremel farm			
		1941		1942	1943
Placement	Fertilizer	Yield	Stand	Yield	Yield
½ inch out	0–20–0	3,380	239	3,960	
½ inch out	0–16–8	3,660	245	4,140	
½ inch out	4–16–8	3,660	249	4,120	3,272
2 inches out	0–20–0	3,080	249		
2 inches out	0–16–8	3,560	246		
2 inches out	4–16–8	3,340	248		
Contact	0–20–0	3,260	231		
Contact	0–16–8	3,380	216		
Contact	4–16–8	2,880	195		
Drilled in	0–20–0	3,260	271	3,600	
Drilled in	0–16–8	3,480	257	4,020	
Drilled in	4–16–8	3,340	257	3,960	3,188
	No fertilizer	3,120	256	3,960	2,776

* See footnote Table 2. "Drilled in" refers to drilling the fertilizer 3 inches deep with a grain drill just before planting the peas. Varieties: Roger's Ace Surprise, 1941; Perfection, 1942; and Roger's Famous, 1943.

ting were greater on the fertilized than on the unfertilized plots.

In 1943, peas responded well to commercial fertilizer, but with a very small difference because of placement. A slightly higher yield of peas was obtained from plots receiving the band placement of fertilizer than from plots in which the fertilizer was drilled in deep before planting.

The data for the six-year period have demonstrated the need for a drill that will place the fertilizer in a band ½ inch to the side and 1½ inches or more below the seed. At the present time no such commercial drill is available. In view of the fact that experimental results from other states (New York, Minnesota, and Washington) agree with the results obtained in Michigan, a challenge is presented to the farm machinery manufacturers to supply the farmer with this type of planting equipment.

Recommendations

Fertilizers for cannery peas should not be placed in contact with the seed.

Fertilizers should be placed in bands approximately ½ inch to the side of the seed and 1½ inches, or more if possible, below the seed. However, there are now no commercial machines available to fertilize peas in this manner, and so the next best method is to drill in the fertilizer 3 inches or more deep just prior to planting. Do not disturb the fertilizer by deep tillage operations after it is drilled into the soil.

A fertilizer containing both phosphorus and potash, 0-14-7 or 0-20-10, should be applied for cannery peas. On the lighter colored soils or on non-livestock farms, or where for any other reason it is felt that nitrogen may be needed, apply a complete fertilizer such as 2-16-8, 2-12-6, or 4-16-4. The rate of application should be 300 pounds per acre.

Afterwards

(*From page* 5)

the veterans of 1914-19 stirred up at first, and some of them even kept going strong as late as the Milwaukee convention of the Legion five years ago. The snake dances on that occasion were a credit to men as far into the forties as they were; and I have seen some high old jinks going on along the home front this year, and not in regimentals either!

So I infer if there is any liquor left when the boys come back, some of us will have to keep sober for a change and let a few of the boys quench themselves. You can't alter the joy-making rules of humanity by solemn pronouncements and dire predictions. For a while there will be unconfined merriment and some clinking and splashing going on—but it won't last very long. And the percentage of those taken to the rest cure will not be as large as the number who have sacrificed a heap more than their sobriety. It calls for a nice blend of tolerance and vigilance. I don't suppose Ma and Pa ought to insist on going to the nightclubs with the boys every time either.

Since when are any of us homebodies in shape to charge the veterans with being extravagant? For four years many of us unused to big incomes have enjoyed good wages and a bonus on top of it. (Except the present white collar crowd.) The only reason we haven't bid like the devil against each other to force prices skyward is a certain unpopular limiting law. But your mud-slogging Yank and sea-going Gob have not benefited by the surge of cash business.

Naturally the few thousands he can borrow from the government on his discharge will look lofty enough after a few years of penny-ante. However, we don't need to fear an invasion of inflaters when the lads return with money burning their pants. If we keep calm during the interval and use our suds wisely on the proper kind of investments and don't buy too much land on a mortgage tied with a loose shoestring, I reckon the situation can be kept well in hand.

I am sure most farm lads upon their first night at home would rather be shown into a cozy bathroom and see Ma cook a meal over a new range and running hot and cold water on tap than to have Pa announce he has bought Binghooter's back forty with the wad he should have plugged into the existing debt.

PUT this down — that anything which has a hazardous air of speculation and risk about it will not be the proper kind of example of financing to lay before the service man with a bonus to spend. If we've been provident and careful ourselves during the big fuss, we can bank on most of the boys behaving well at the bank afterwards. The best way to prevent them from being caught with a "copper mine" is not to buy any such stock ourselves.

My third query is in this shape:

(3) Will they be crusaders, want to make the world safe for everything that is holy, and insist on adding a few more sanctimonious dictums to the Atlantic Charter?

My idea is that the average Yank is just about as much imbued with a reform spirit over there as a husky football player is in respect to tinkering with the college curriculum after winning a game. The lads went over there simply because they had to, it was our move on the grand old checkerboard, and unless we wanted to see the enemy move some men into our king row we had to do some fast work.

You won't find any Sir Lancelot romantics among the vets. (Except incidentally when obliged to tender kindnesses to the weak and unfortunate.) Maybe there were some ideologies bruited about while we were get-

ting up steam, something to afford us a rallying cry, but we knew full well that Sherman described war exactly right and we had no illusions about one cause being all sacred and the other all evil.

I am satisfied about this too, because we are not in a mood to kid ourselves. This being the case, we are not quite so apt to be sour and disillusioned afterwards. If we were that way many of us would get cynical and bitter. We would feel that our achievement went far short of our destiny, to create a free world for the vanquished and a new deal for everybody. Not having clung to any impossible and impractical thesis of war aims, it leaves the Yanks in the role they relish best—fire-fighters and road-builders rather than metaphysical professors and theological preachers. When the fires are out and new roads built, the foreigners can plan their own future better than we can do it for them.

My final query is:

(4) Will they be shrewd and crafty about political pelf and preference for themselves and insist on giving all the good things to service personnel?

IF my boy is any index, the average service man has had little or no liking for or experience with everyday politics as it's played back home. To be sure, there will be plenty of gifted and able leaders among them who have a penchant for politics and who will delight in maneuvers and domestic campaigns.

At first the main pressure for preference to the returned veterans will be in Congress and among the civilian hero-worshippers. Of course, that won't last more than a year or so at best, and then the vets will be obliged to get well "organized" so as to get a decent hearing on anything. When uniforms are discarded and army equipment is hawked off to the slickest bidder, the glamour and salvos will die down and the only toe-hold the vets will have is some friends in office.

A bigger battle looms than this. Its problems and its reactions cut across all lines of service and non-service. I refer to the question we must settle at once—how to find leisure for all and idleness for none. Americans, after a war in which some sacrifice has come to the majority, after a decade of blue funk and depression preceding it, they will have a right to demand some leisure and no idleness and want.

I DO not think there is any other question visible now in the minds of parents and relatives, as well as in the hearts of the furloughed soldiers, which transcends this one. We are keeping that old frazzled slogan about "a world safe for democracy" among the relics of back waters. The equally puerile shibboleth "a war to end wars" is laid aside for good. But what we cling to and ask for as a modest reward for loyalty and courage is some sound scheme which will loosen the bonds of economic stagnation and give us leisure when we need it for refreshment, but not too much of it to make us weary and sore.

Along with this urge for steady employment at useful and fascinatingly modern jobs, we retain dim hopes that things will shape themselves everywhere by degrees so that it will not be necessary to load up the cannon and fire the torpedoes each time that men can't find enough work to do.

We made a lot of fun about "make work" projects, but they are a darn-sight better than "make war" projects, of which we have already seen too much. One man leaning on a crutch is worse than a dozen guys leaning on shovels. How about adopting that one for a cute little campaign emblem?

I had come to the end of my reveries just as the front door slammed on the mailman with his message from the front. It says that all was well six weeks ago. Well, all I can do now is to finish these screens, or conditions won't be so good around here six weeks hence.

OFFSHOOT

Sapphira Ann, the colored washlady, was very proud of her children, of which she had "raised eight head," as she put it, and all of them girls. When she was asked one day to give the names of her children she explained that she had chosen flower names for all of them.

Then she proceeded: "De oldest one is named Gladiola, de nex' one is Pansy, de third one is Heliotrope, de fourth one is Violet, de fifth one is Daisy, de sixth one is Petunia, de seventh one is Morning Glory an' de las' one is Artifishul."

Suspicious WAC: Look here, soldier, what's your objective?

Enamored Pfc.: In the words of Roosevelt and Churchill—unconditional surrender!

Tommy (saying his prayers sleepily) —"Now I lay me down to sleep; I pray the Lord my soul to keep . . ."

Mother (prompting)—"If . . ."

Tommy (almost asleep)—"If he hollers let him go, eeny, meeny, miny, mo!"

HOW MUCH PAINT?

"I told Tom that the average woman's clothing weighs only eight ounces."

"And what did he say?"

"He thought it was a shame that they had to wear such heavy shoes."

Consider the plight of the average girl back home. Once she used to say, "What a man!" Then it became, "What, a man?" and now it's, "What's a man?"

A bachelor may know all there is to know about women, but he won't get the truth about himself until he's married.

Burglar: "Don't be scairt, old lady, all I want is your money and . . ."

Old Maid: "Oh, go away. You're just like all the other men."

It was during a big bargain sale and tempers were rising. "If I were trying to match politeness," said the woman customer, glaring at the salesgirl, "I'd have a hard time finding it here."

"Will you kindly let me see your sample, madam?" the salesgirl replied.

Lips that touch whisky
And lips that touch brew
Are always the first lips
To say "I love you."

"Do you belong," asked the clerk, "to the Nazi Bund, or to any political party that plans to overthrow the government?"

"Yas'm," said the Negro.

"Which one?" asked the clerk, taken aback by the applicant's placid candor.

"The Republican," was the earnest reply.

It's hard to date women war workers. They aren't satisfied with a good time —they want time and a half.

A Southern gentleman objects to the use of "Yanks" to denote American soldiers in recent headlines. Well, there wasn't room in the line to say Damyanks.

Need for—

BORON IN AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work of the State Agricultural Stations and recommendations of the County Agents are steadily increasing the recognition of the need for Boron in agriculture. We are prepared to render every practical assistance.

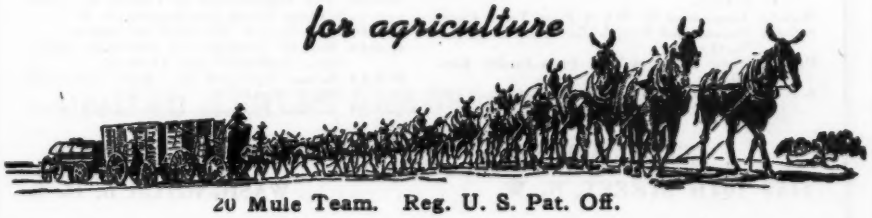
Borax is economical and very little is required. It is conveniently packed in 100 lb. sacks and stocks are available for prompt delivery everywhere in the United States and Canada. Address your inquiries to the nearest office.

PACIFIC COAST BORAX COMPANY

NEW YORK CHICAGO LOS ANGELES

BORAX

for agriculture



20 Mule Team. Reg. U. S. Pat. Off.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

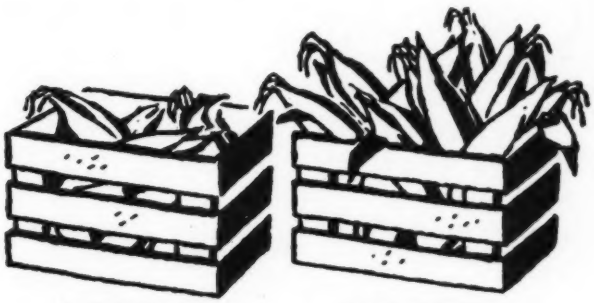
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
H-3-42 Legumes Are Essential to Sound Agriculture
I-3-42 High-grade Fertilizers Are More Profitable
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
Y-8-42 The Southeast Can Grow Clover and Alfalfa
AA-10-42 Growing Legumes for Nitrogen
DD-10-42 Clover Pastures for the Coastal Plains
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizer
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
B-1-43 Crotalaria—A Crop That Grows Like Weeds
C-1-43 Quality in Grasses for Pasture and Hay
F-1-43 Boron Improves Canning Beets
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
T-4-43 Fertilizing Tung Trees by Leaf Analysis
V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
HH-8-43 More Soybeans, Please!
JJ-10-43 Soil Management for Field Beans
KK-11-43 How Rotation Paid in North Carolina
LL-11-43 The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil
MM-11-43 Mississippi Farmers Improve Their Soil
NN-11-43 Maintaining Available Potassium in Soils
OO-11-43 Kudzu Conserves Southern Soils
PP-12-43 Commercial Fertilizers for Livestock Farms
QQ-12-43 Potash in War Production.
A-1-44 What's in That Fertilizer Bag?
B-1-44 Available Potash in the Surface Soils of Georgia
C-1-44 Adjustment of Agriculture to Its Environment
D-2-44 Potassium Content and Potash Requirement of Louisiana Soils
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
G-2-44 The Use of Borax in the Legume-Livestock Program of the South
H-2-44 Efficient Fertilizers for Potato Farms
I-3-44 Doubling Production by Bettering Soils
J-3-44 The Response of Various Crops to Potash Fertilization in South Carolina
K-3-44 Soil Tests Indicate Potash Levels
L-3-44 South Finds Clovers Excel in Profits
M-4-44 The Importance of Potash in Maintaining Food Production in N. C.
N-4-44 The Potash Problem in Illinois
O-4-44 Record Supplies of Fertilizer Materials Indicated for 1944-45
P-4-44 Borax Sprayed on Beets Controls Black Spot
Q-4-44 A New Approach to Extension Work

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. **WASHINGTON 6, D. C.**



UNTREATED SEEDS SPERGON TREATED

GREATER YIELDS AND STANDS

WHEN SEEDS ARE TREATED WITH

Spergon

REG. U. S. PAT. OFF.

THE PROVEN SEED PROTECTANT

The ability of this fungicide to prevent seed decay, stimulate growth, and provide healthy plants that give greater yields has been proven by many growers and unbiased experiment stations. Spergon is long lasting, compatible with inoculants, safe to use and is inexpensive crop insurance. *For complete information and distributors' names write*

UNITED STATES RUBBER COMPANY

Naugatuck Chemical Division

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

MOTION PICTURES

EDUCATIONAL FILMS AVAILABLE

Save That Soil

A 16mm., sound, color film depicting the early South, the results of the one-crop system, and the reclamation and conservation of Southern soils through the use of legumes and modern methods of soil management.
Running time, 28 min. (on 1200-ft. reel).

Other 16MM. COLOR FILMS AVAILABLE

Potash in Southern Agriculture
In the Clover
Bringing Citrus Quality to Market
Machine Placement of Fertilizer
Ladino Clover Pastures
Potash from Soil to Plant
Potash Deficiency in Grapes and Prunes
New Soils from Old
Potash Production in America

We shall be pleased to loan any of these films to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible) and period of time of loan.

For additional information write:

AMERICAN POTASH INSTITUTE, INC.
1155 Sixteenth Street **Washington 6, D. C.**

Printed in U.S.A.